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

Electronics & Communication Enginnering

SIR CHHOTU RAM INSTITUTE OF ENGINEERING & TECHNOLOGY

CH,CHARAN SINGH UNIVERSITY MEERUT

2020-21

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 therequired 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".

(b) 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 semesterexamination 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 clearedany 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 evensemester.

10.2 For promotion from even semester to the next odd semester (i.e. of the next academicyear) 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 semestersare 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 earned17.5 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 gradesin 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 semestersofsame 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.AbdulKalam Technical University (APJAKTU) Lucknow adopts absolutegrading 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 Course 1	Credit 5.5	Grade letter B^+	Grade point 8	Credit Point (Credit x Grade) 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 Course 1	Credit 5.5	Grade letter B^+	Grade point 8	Credit Point (Credit x Grade) 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 afterthe 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 below6.5 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.

PROGRAM OUTCOMES

PO 1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO 2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO 3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

PO 5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

PO 6 The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO 7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO 8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO 9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO 10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO 12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO 1 To analyze, design and develop solutions by applying foundational concepts of electronics and communication engineering.

PSO 2 To apply design principles and best practices for developing quality products for scientific and business applications.

PSO 3 To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions to existing/novel

Course Structure and Evaluation Scheme for B.Tech.

SEMESTER-I

S. No.	Subject Name	Subject Code	PERIODS			EVALUATION SCHEME			END SEMESTER			Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	Engineering Mathematics – I	BT – 105	3	1	0	30	20	50	-	100	-	150	4
2.	Engineering Physics / Engineering Chemistry	BT – 104/ BT - 103	3	1	0	30	20	50	-	100	-	150	4
3.	Basic Electrical Engineering / Emerging Domain in Electronics Engineering	BT – 101/ BT – 107	3	0	0	30	20	50	-	100	-	150	3
4.	Programming for Problem Solving/ Fundamentals of Mechanical Engineering & Mechatronics	BT – 102/ BT – 106	3	0	0	30	20	50	-	100	-	150	3
5.	Emerging Technology for Engineering / AI for Engineering	BT – 108/ BT – 109	2	0	0	15	10	25	-	25	-	50	2
6.	**Soft Skill – I**	BT - 110	2	0	0	15	10	25	-	25	-	-	NC
7.	Engineering Physics Lab / Engineering Chemistry Lab	BT – 154/ BT – 153	0	0	2	-	-	-	25	-	25	50	1
8.	Basic Electrical Engineering Lab / Electronics Engineering Lab	BT – 151/ BT – 157	0	0	2	-	-	-	25	-	25	50	1
9.	Programming for Problem Solving Lab / English Language Lab	BT – 152/ BT – 158	0	1	2	-	-	-	25	-	25	50	1

10.	Engineering Graphics & Design Lab/ Mechanical Workshop Lab	BT – 155/ BT – 156	0	1	2	-	-	-	50	-	50	100	1
11.	(For B. Tech. Hons. Degree)*												
	Total											**900**	**20**

SEMESTER-II

S. No.	***Subject Name***	***Subject Code***	***PERIODS***			***EVALUATION SCHEME***				***END SEMESTER***		***Total***	***Credit***
			L	***T***	***P***	***CT***	***TA***	***Total***	***PS***	***TE***	***PE***		
3 WEEKS COMPULSORY INDUCTION PROGRAM													
1.	*Mathematics – II*	*BT – 205*	*3*	*1*	*0*	*30*	*20*	*50*	*-*	*100*	*-*	*150*	*4*
2.	*Physics /* *Chemistry*	*BT – 204/* *BT - 203*	*3*	*1*	*0*	*30*	*20*	*50*	*-*	*100*	*-*	*150*	*4*
3.	*Basic Electrical Engineering /* *Programming for Problem Solving*	*BT – 201/* *BT – 202*	*3*	*1*	*0*	*30*	*20*	*50*	*-*	*100*	*-*	*150*	*4*
4.	*Professional English*	*BT – 206*	*2*	*0*	*2*	*30*	*20*	*50*	*-*	*100*	*-*	*150*	*3*

5.	*Physics / Chemistry*	*BT – 254/ BT – 253*	*0*	*0*	*3*	*-*	*-*	*-*	*25*	*-*	*25*	*50*	*1.5*
6.	*Basic Electrical Engineering / Programming for Problem Solving*	*BT – 251/ BT – 252*	*0*	*0*	*2*	*-*	*-*	*-*	*25*	*-*	*25*	*50*	*1*
7.	*Engineering Graphics & Design / Workshop Practices*	*BT – 255/ BT – 256*	*1*	*0*	*4*	*-*	*-*	*-*	*25*	*-*	*25*	*50*	*3*
	*(For B. Tech. Hons. Degree)**												*0*
	Total											***750***	***20 .5***
Mini Project or Internship(3-4 weeks) shall be conducted during summer break after II semester and will be assessed during III Semester													

SEMESTER III

S. No.	Subject Name	Subject Code	Periods			Evaluation Scheme			End Semester			Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	Digital System Design	BT – 301	3	1	0	30	20	50	-	100	-	150	4
2.	Network Analysis and Synthesis	BT – 302	3	0	0	30	20	50	-	100	-	150	3
3.	Electronic Devices	BT – 303	3	1	0	30	20	50	-	100	-	150	4
4.	*Engineering Science Course/ Mathematics – IV	*BT - / BT – 305	3	1	0	30	20	50	-	100	-	150	4
5.	Computer System Security/ Python Programming	BT – 309 /BT – 310	2	0	0	15	10	25	-	50	-	-	0
6.	Universal Human Values / Technical Communication	BT – 314 / BT – 304	3 / 2	0 / 1	0 / 0	30	20	50	-	100	-	150	3
7.	Digital System Design Lab	BT – 351	0	0	2	-	-	-	25	-	25	50	1
8.	Network Analysis and Synthesis Lab	BT – 352	0	0	2	-	-	-	25	-	25	50	1

9.	Electronics Devices Lab	BT – 353	0	0	2	-	-	-	25	-	25	50	1
10.	Mini Project or Internship Assessment	BT – 354	0	0	2	-	-	50	-	-	-	50	1
11.	MOOCs (Essential for Hons. Degree												
	Total							**950**	**22**				

* The Mini Project or internship (3-4 weeks) conducted during summer break after II Semester and will be assessed during III Semester.

***Engineering Science Course:-**

1 Engineering Mechanics - BT – 319

2. Basics Data Structure & Algorithms - BT – 320

3 Material Science - BT – 321
4. Energy Science & Engineering - BT – 322
5. Sensor & Instrumentation - BT – 323

6. Introduction to Soft Computing BT – 324

7 Analog Electronics - BT – 325
8. Electronics Engineering - BT – 326

SEMESTER - IV

S. No.	Subject Name	Subject Code	Periods			heEvaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	Communication Engineering	BT – 401	3	0	0	30	20	50	-	100	-	150	3
2.	Analog Circuits	BT – 402	3	1	0	30	20	50	-	100	-	150	4
3.	Signal System	BT – 403	3	1	0	30	20	50	-	100	-	150	4
4.	*Engineering Science Course/ Mathematics – IV	*BT - / BT – 405	3	1	0	30	20	50	-	100	-	150	4
5.	Computer System Security/ Python Programming	BT – 409 /BT – 410	2	0	0	15	10	25	-	50	-	-	0
6.	Universal Human Values / Technical Communication	BT – 414 / BT – 404	3 2	0 1	0 0	30	20	50	-	100	-	150	3
7.	Communication Engineering Lab	BT – 451	0	0	2	-	-	-	25	-	25	50	1
8.	Analog Circuits Lab	BT – 452	0	0	2	-	-	-	25	-	25	50	1
9.	Signal System	BT –	0	0	2	-	-	-	25	-	25	50	1

	Lab	453											
10.	MOOCs (Essential for Hons. Degree												
	Total											**900**	**21**

***Engineering Science Course:-**

1. Engineering Mechanics -BT – 419

2. Basics Data Structure & Algorithms BT – 420

3. Material Science BT – 421
4. Energy Science & Engineering -BT – 422
5. Sensor & Instrumentation -BT – 423

6. Introduction to Soft Computing -BT – 424

7 Analog Electronics - BT – 425
8. Electronics Engineering - BT – 426

SEMESTER-V

S. No.	Subject Name	Subject Code No.	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	Integrated Circuits	BT – 501	3	1	0	30	20	50		100		150	4
2.	Microprocessor & Microcontroller	BT – 502	3	1	0	30	20	50		100		150	4
3.	Digital Signal Processing	BT – 503	3	1	0	30	20	50		100		150	4
4.	**Department Elective - I** VLSI Technology	BT – 504	3	0	0	30	20	50		100		150	3
5.	**Department Elective – II** Electronics Switching	BT – 505	3	0	0	30	20	50		100		150	3
6.	Indian Tradition, Culture and Society/ Constitution of India	BT – 509 / BT - 510	2	0	0	15	10	25		50		50	NC
7.	Integrated Circuits Lab	BT – 551	0	0	2				25		25	50	1
8.	Microprocessor & Microcontroller Lab	BT – 552	0	0	2				25		25	50	1
9.	Digital Signal Processing Lab	BT – 553	0	0	2				25		25	50	1
10.	Mini Project/Internship	BT – 554	0	0	2				50				1

	**												
11.	MOOCs (Essential for Hons. Degree)												
	Total		**17**	**3**	**8**							**950**	**22**

**

The Mini Project or Internship (4weeks) conducted during summer break after IVth Semester and will be assessed during Vth Semester.

SEMESTER - VI

S. No.	Subject Name	Subject Code No.	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	Digital Communication	BT – 601	3	1	0	30	20	50		100		150	4
2.	Control System	BT – 602	3	1	0	30	20	50		100		150	4
3.	Antenna and Wave Propagation	BT – 603	3	1	0	30	20	50		100		150	4
4.	**Department Elective - III** Data Communication Networks	BT – 604	3	0	0	30	20	50		100		150	3
5.	**Department Elective – I** IDEA to Business Model	BT – 605	3	0	0	30	20	50		100		150	3
6.	Indian Tradition, Culture and Society/ Constitution of India	BT – 609 / BT - 610	2	0	0	15	10	25		50		50	NC
7.	Digital Communication Lab	BT – 651	0	0	2				25		25	50	1
8.	Control	BT –	0	0	2				25		25	50	1

	Systems Lab	652											
9.	Elective Lab	BT – 653	0	0	2				25		25	50	1
10.	MOOCs (Essential for Hons. Degree)												
	Total		**17**	**3**	**6**							**900**	**21**

SEMESTER - VII

S. No.	Subject Name	Subject Code No.	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	Project Management & Entrepreneurship	BT – 701	3	0	0	30	20	50		100		150	3
2.	Renewable Energy Resources	BT – 702	3	0	0	30	20	50		100		150	3
3.	**Department Elective – IV** VLSI Design	BT – 703	3	0	0	30	20	50		100		150	3
4.	**Department Elective – V** Information Theory & Coding	BT – 704	3	0	0	30	20	50		100		150	3
5.	VLSI Design Lab	BT – 753	0	0	2				25		25	50	1
6.	Mini Project or Internship Assessment**	BT – 751	0	0	2				50			50	1
7.	Project I	BT – 752	0	0	8				150			150	4
	MOOCs (Essential for Hons. Degree)												
	Total											**850**	**18**

SEMESTER - VIII

S. No.	Subject Name	Subject Code	L – T - P	ESE Marks	Sessional		Total	Credit
					CT	TA		
1.	Renewable Energy Resources	BT - 806	3-0-0	70	20	10	100	3
2.	Wireless & Mobile Communication	BT - 802	3-0-0	70	20	10	100	3
3.	Electronics Switching	BT - 803	3-1-0	70	20	10	100	4
4.	Project	BT - 851	0-0-2	350	-	250	600	12
5.	GD & Seminar	BT - 852	0-0-2	-	-	100	100	2
	Total			**560**	**60**	**380**	**1000**	**24**

BT-104

ENGINEERING PHYSICS

L T P

3 1 0

Course Outcomes (COs)

At the end of this course students will demonstrate the ability to:

1. To solve the classical and wave mechanics problems
2. To develop the understanding of laws of thermodynamics and their application in various processes
3. To formulate and solve the engineering problems on Electromagnetism & Electromagnetic FieldTheory
4. To aware of limits of classical physics & to apply the ideas in solving the problems in their parent Streams

Unit -1

I **Relativistic Mechanics:** Frame of reference, Inertial & non-inertial frames, Galilean transformations, Michelson- Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, Variation of mass with velocity, Einstein‟s mass energy relation, Relativistic relation between energy and momentum, Massless particle. 8

Unit -II

Electromagnetic Field Theory: Continuity equation for current density, Displacement current, Modifying equation for the curl of magnetic field to satisfy continuity equation, Maxwell‟s equations in vacuum and in non conducting medium, Energy in an electromagnetic field, Poynting vector and Poynting theorem, Plane electromagnetic waves in vacuum and their transverse nature. Relation between electric and magnetic fields of an electromagnetic wave, Energy and momentum carried by electromagnetic waves, Resultant pressure, Skin depth. 8

Unit -III

Quantum Mechanics: Black body radiation, Stefan‟s law, Wien‟s law, Rayleigh-Jeans law and Planck‟s law, Wave particle duality, Matter waves, Time-dependent and time-independent Schrodinger wave equation, Born interpretation of wave function, Solution to stationary state Schrodinger wave equation for one-Dimensional particle in a box, Compton effect. 8

Unit –IV

Wave Optics: Coherent sources, Interference in uniform and wedge shaped thin films, Necessity of extended sources, Newton's Rings and its applications. Fraunhoffer diffraction at single slit and at double slit, absent spectra, Diffraction grating, Spectra with grating, Dispersive power, Resolving power of grating, Rayleigh‟s criterion of resolution, Resolving power of grating. 8

Unit -V

Fibre Optics & Laser: Optics**:** Introduction to fibre optics, Acceptance angle, Numerical aperture, Normalized frequency, Classification of fibre, Attenuation and Dispersion in optical fibres. Laser: Absorption of radiation, Spontaneous and stimulated emission of radiation, Einstein‟s coefficients, Population inversion, Various levels of Laser, Ruby Laser, He-Ne Laser, Laser applications. 8

Reference Books:

1. Concepts of Modern Physics – Aurthur Beiser (McGraw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wiley)
3. Optics – Brijlal & Subramanian (S. Chand)
4. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
5. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New)
6. Engineering Physics-Malik HK and Singh AK (McGrawHill)

BT-103

Engineering Chemistry

L T P

3 1 0

COURSE OUTCOMES (COs)

At the end of this course students will demonstrate the ability to

1. Use of different analytical instruments.
2. Measure molecular/ system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction

Unit- I

Atomic and Molecular Structure: Molecular orbital's of diatomic molecules. Band theory of solids. Liquid crystal and its applications. Point defects in solids. Structure and applications of Graphite and Fullerenes. Concepts of Nano-materials and its application. 8

Unit –II

Spectroscopic techniques and Applications: Elementary idea and simple applications of Rotational, Vibrational, Ultraviolet& Visible and Raman spectroscopy. 8

Unit –III

Electrochemistry: Nernst Equation and application, relation of EMF with thermodynamic functions (ΔH, ΔF and Δ S). Lead storage battery.
Corrosion; causes, effects and its prevention.
Phase Rule and its application to water system. 8

Unit –IV

Water Analysis; Hardness of water, Techniques for water softening (Limesoda, Zeolite, Ion exchange resin and Reverse osmosis method).
Fuels: classification of fuels, Analysis of coal, Determination of calorific value (Bomb calorimeter and Dulong's methods). 8

Unit –V

Polymer; Basic concepts of polymer-Blend and composites, Conducting and biodegradable polymers. Preparation and application of some industrially important polymers (Buna-S, Buna-N, Neoprene, Nylon-6, nylon-6, 6 and Terylene). General methods of synthesis of organo metallic compounds (Grignard reagent) and their applications.
8

Text Books:

1. University Chemistry By B.H. Mahan
2. University Chemistry By C.N.R. Rao
3. Organic Chemistry By I.L. Finar
4. Physical Chemistry By S. Glasstone
5. Engineering Chemistry By S.S. Dara
6. Polymer Chemistry By Fre W., Billmeyer
7. Engineering Chemistry By Satya Prakash

BT-101

Basic Electrical Engineering

L T P
3 1 0

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
2. Analyze the steady state behavior of single phase and three phase AC electrical circuits.
3. Identify the application areas of a single phase two winding transformer as well as an auto transformer and calculate their efficiency. Also identify the connections of a three phase transformer.
4. Illustrate the working principles of induction motor, synchronous machine as well as DC machine and employ them in different area of applications.
5. Describe the components of low voltage electrical installations and perform elementary calculations for energy consumption.

Unit-I

DC Circuits : Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Superposition theorem, Thevenin theorem, Norton theorem. 8

Unit –II

Steady- State Analysis of Single Phase AC Circuits: Representation of Sinusoidal waveforms – Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidal varying voltage and current. Analysis of single phase AC Circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel), Apparent, active & reactive power, Power factor, power factor improvement. Concept of Resonance in series & parallel circuits, bandwidth and quality factor. Three phase balanced circuits, voltage and current relations in star and delta connections. 8

Unit -III

Transformers: Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections. 8

Unit –IV

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, Sliptorque 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. 8

Unit –V

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Importance of earthing. Types of Batteries, Important characteristics for Batteries. Elementary calculations for energy consumption and savings, battery backup 8

Text Book:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", McGraw Hill.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.
3. Ritu Sahdev, "Basic Electrical Engineering", Khanna Publishing House.
4. S. Singh, P.V. Prasad, "Electrical Engineering: Concepts and Applications" Cengage

Reference Books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.
3. V. D. Toro, "Electrical Engineering Fundamentals", Pearson India.

BT-105
ENGINEERING MATHMATICS I

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1 Remember the concept of matrices and apply for solving linear simultaneous equations.

2 Understand the concept of limit , continuity and differentiability and apply in the study of Rolle,s , Lagrange,s and Cauchy mean value theorem and Leibnitz theorems .

3 Identify the application of partial differentiation and apply for evaluating maxima, minima, series and Jacobians

4 Illustrate the working methods of multiple integral and apply for finding area, volume, centre of mass and centre of gravity.

5 Remember the concept of vector and apply for directional derivatives, tangent and normal planes. Also evaluate line, surface and volume integrals.

Unit –I

Matrices: Types of Matrices: Symmetric, Skew-symmetric and Orthogonal Matrices; Complex Matrices, Inverse and Rank of matrix using elementary transformations, Rank-Nullity theorem; System of linear equations, Characteristic equation, Cayley-Hamilton Theorem and its application, Eigen values and eigenvectors; Diagonalisation of a Matrix 8

Unit –II

Differential Calculus- I: Introduction to limits, continuity and differentiability, Rolle's Theorem, Lagrange's Mean value theorem and Cauchy mean value theorem, Successive Differentiation (nth orderderivatives), Leibnitz theorem and its application, Envelope of family of one and two parameter, Curve tracing: Cartesian and Polar co-ordinates 8

Unit -III

Differential Calculus-II: Partial derivatives, Total derivative, Euler's Theorem for homogeneous functions, Taylor and Maclaurin's theorems for a function of two variables, Maxima and Minima of functions of several variables, Lagrange Method of Multipliers, Jacobians, Approximation of errors

8

Unit -IV

Multivariable Calculus-I: Multiple integration: Double integral, Triple integral, Change of order of integration, Change of variables,

Application: Areas and volumes, Center of mass and center of gravity (Constant and variable densities)

8

Unit -V

Vector Calculus: Vector identities (without proof), Vector differentiation: Gradient, Curl and Divergence and their Physical interpretation, Directional derivatives.

Vector Integration: Line integral, Surface integral, Volume integral, Gauss's Divergence theorem, Green's theorem and Stoke's theorem (without proof) and their applications

8

Text Books:

1. B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Publishing Company Ltd., 2008.

2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R K. Jain & S R K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House 2002.

Reference Books:

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Veerarajan T., Engineering Mathematics for first year, McGraw-Hill, New Delhi, 2008.
6. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, McGraw-Hill; Sixth Edition.
7. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson Education.
8. Advanced Engineering Mathematics. Chandrika Prasad, Reena Garg, 2018.
9. Engineering Mathemathics – I. Reena Garg, 2018.

BT-205

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:

1 Understand the concept of differentiation and apply for solving differential equations.
2 Remember the concept of definite integral and apply for evaluating surface areas and volumes.
3 Understand the concept of convergence of sequence and series. Also evaluate Fourier series
4 Illustrate the working methods of complex functions and apply for finding analytic functions.
5 Apply the concept of complex functions for finding Taylor's series, Laurent's series and evaluation of definite integrals..

Unit –I

Ordinary Differential Equation of Higher Order: Linear differential equation of nth order with constant coefficients, Simultaneous linear differential equations, Second order linear differential equations with variable coefficients, Solution by changing independent variable, Reduction of order, Normal form, Method of variation of parameters, Cauchy-Euler equation.

8

Unit –II

Multivariable Calculus-II: Introduction of Improper integrals, Beta & Gama function and their properties, Dirichlet's integral and its applications, Application of definite integrals to evaluate surface areas and volume of revolutions.

8

Unit -III

Sequences and Series: Definition of Sequence and series with examples, Convergence of sequence and series, Tests for convergence of series, (Ratio test, D' Alembert's test, Raabe's test). Fourier series, Half range Fourier sine and cosine series.

8

Unit -IV

Complex Variable–Differentiation: Limit, Continuity and differentiability, Functions of complex variable, Analytic functions, Cauchy- Riemann equations (Cartesian and Polar form), Harmonic function, Method to find Analytic functions, Conformal mapping, Mobius transformation and their properties.

8

Unit –V

Complex Variable –Integration: Complex integrals, Contour integrals, Cauchy- Integral theorem, Cauchy integral formula, Taylor's and Laurent's series (without proof), Singularities, Classification of Singularities, zeros of analytic functions, Residues, Methods of finding residues, Cauchy Residue theorem, Evaluation of real integrals of the types $\int_0^{2\pi} f(\cos\theta, \sin\theta)\,d\theta$ and $\int_{-\infty}^{\infty} f(\cos\theta, \sin\theta)\,d\theta$ only.

8

Text Books:

1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.

2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R. K. Jain & S. R. K. Iyenger, Advance Engineering Mathematics , Narosa Publishing House, 2002

Reference Books:

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R.Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. G.B Thomas, R L Finney, Calculus and Analytical Geometry, Ninth Edition Pearson, 2002.
5. James Ward Brown and Ruel V Churchill, Fourier Series and Boundary Value Problems, 8th Edition-McGraw-Hill
6. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
7. Veerarajan T., Engineering Mathematics for first year, McGraw-Hill, New Delhi, 2008.
8. Charles E Roberts Jr, Ordinary Diffrential Equations, Application, Model and Computing, CRC Press T&F Group.
9. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, 6thEdition, McGraw-Hill.
10. James Ward Brown and Ruel V Churchill, Complex Variable and Applications, 8th Edition, McGraw-Hill.
11. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.
12. Advanced Engineering Mathematics By Chandrika Prasad, Reena Garg Khanna Publishing House, Delhi.

BT-202

PROGRAMMING FOR PROBLEM SOLVING

3L:0T:0P

Course Outcomes:

At the end of this course students will be able to:

1. To develop simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To implement conditional branching, iteration and recursion.
4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
5. To use arrays, pointers and structures to develop algorithms and programs.

Unit -I

Introduction to Programming: Introduction to components of a computer system: Memory, processor, I/O Devices, storage, operating system, Concept of assembler, compiler, interpreter, loader and linker.**Idea of Algorithm:** Representation of Algorithm, Flowchart, Pseudo code with examples, From algorithms to programs, source code.**Programming Basics:** Structure of C program: writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language: Standard I/O in C,Fundamental data types, Variables and memory locations, Storage classes.

8

Unit –II

Arithmetic expressions & Conditional Branching: Arithmetic expressions and precedence: Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associatively. **Conditional Branching:** Applying if and switch statements, nesting if and else, use of break and default with switch.

8

Unit –III

Loops & Functions: Iteration and loops: 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 parameters to functions, call by value, call by reference, recursive functions.

8

Unit –IV

Arrays & Basic Algorithms: Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays. Character arrays and strings, Structure, union, enumerated data types, Array of structures, Passing arrays to functions. **Basic Algorithms:** Searching &Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, Notion of order of complexity.

8

Unit –V

Pointer& File Handling: Pointers: Introduction, declaration, applications, Introduction to dynamic memory allocation (malloc, calloc, realloc, free), Use of pointers in self-referential

structures, notion of linked list (no implementation) **File handling:** File I/O functions, Standard C preprocessors, defining and calling macros, command-line arguments.

8

Text Books:

1. Schum‟s Outline of Programming with C by Byron Gottfried, McGraw-Hill
2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education.
3. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited, 2015.
4. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House
5. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
6. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
7. Let Us C By Yashwant P. Kanetkar.
8. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.
9. Programming in C by Kochan Stephen G. Pearson Education – 2015.
10. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication.
11. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication.
12. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
13. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication
14. Problem Solving and Programming in C, R.S. Salaria, Khanna Publishing House.

BT-106

FUNDAMENTAL OF MECHANICAL ENGINEERING AND MECHATRONICS

3L:0T:0P

Course Outcomes:

The students will be able to
1 Understand the concept of stress and strain, factor of safety, beams
2 Understand the basic component and working of internal combustion engines, electric and hybrid vehicles, refrigerator and heat pump, airconditioning.
3 Understand fluid properties, conservation laws, hydraulic machinery used in real life.
4 Understand the working principle of different measuring instrument with the knowledge of accuracy, error and calibration, limit, fit, tolerance and control system.
5 Understand concept of mechatronics with their advantages, scope and Industrial application, the different types of mechanical actuation system, the different types of hydraulic and pneumatic systems.
6 Apply concepts of strength of material for safe design, refrigeration for calculation of COP, concepts of fluid mechanics in real life, concepts of measurements in production systems.

Unit I: Introduction to Mechanics of Solid:
Normal and shear Stress, strain, Hookes' law, Poisson's ratio, elastic constants and their relationship, stress-strain diagram for ductile and brittle materials, factor of safety. Basic Numerical problems. Types of beams under various loads, Statically Determinate Beams, Shear force and bending moment in beams, Shear force and bending moment diagrams, Relationships between load, shear and bending moment. Basic Numerical problems.

8

Unit II Introduction to IC Engines and RAC:
IC Engine: Basic Components, Construction and Working of Two stroke and four stroke SI & CI engine, merits and demerits, scavenging process; Introduction to electric, and hybrid electric vehicles. **Refrigeration:** Its meaning and application, unit of refrigeration; Coefficient of performance, methods of refrigeration, construction and working of domestic refrigerator, concept of heat pump. Formula based numerical problems on cooling load. **Air-Conditioning:** Its meaning and application, humidity, dry bulb, wet
bulb, and dew point temperatures, comfort conditions, construction and working of window air conditioner.

10

Unit III Introduction to Fluid Mechanics and Applications:
Introduction: Introduction: Fluids properties, pressure, density, dynamic and kinematic viscosity, specific gravity, Newtonian and Non-Newtonian fluid, Pascal's Law, Continuity Equation, Bernaulli's Equation and its applications, Basic Numerical problems.Working principles of hydraulic turbines & pumps and their classifications, hydraulic accumulators, hydraulic lift and their applications.

7

Unit IV Measurements and Control System: Concept of Measurement, Error in measurements, Calibration, measurements of pressure, temperature, mass flow rate, strain, force and torques; Concept of accuracy, precision and resolution, Basic Numerical problems. System of Geometric Limit, Fit, Tolerance and gauges, Basic Numerical problems. **Control System Concepts:** Introduction to Control Systems, Elements of control system, Basic of open and closed loop control with example. 8

Unit V Introduction to Mechatronics

Evolution, Scope, Advantages and disadvantages of Mechatronics, Industrial applications of Mechatronics, Introduction to autotronics, bionics, and avionics and their applications. Sensors and Transducers: Types of sensors, types of transducers and their characteristics.**Overview of Mechanical Actuation System** – Kinematic Chains, Cam,Train Ratchet Mechanism, Gears and its type, Belt, Bearing, **Hydraulic and Pneumatic Actuation Systems:** Overview: Pressure Control Valves, Cylinders, Direction Control Valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing Problems.
8

Reference Books:

1. Basic Mechanical Engineering, G Shanmugam, S Ravindran, McGraw Hill
2. Basic Mechanical Engineering, M P Poonia and S C Sharma, Khanna Publishers
3. Mechatronics : Principles, Concepts and Applications, Nitaigour Mahalik, McGraw Hill
4. Mechatronics, As per AICTE: Integrated Mechanical Electronic Systems, K.P. Ramachandran, G.K. Vijayaraghavan, M.S.Balasundaram, Wiley India
5. Mechanical Measurements & Control, Dr. D. S. Kumar. Metropolitan Book Company
6. Fluid Mechanics and Hydraulic Machines, Mahesh Kumar, Pearson India

BT-108

EMERGING TECHNOLOGY FOR ENGINEERING

2L:0T:0P

Course Outcomes:

The students will be able to

1 Understand the concepts of internet of things, smart cities and industrial internet of things
2 Understand the concepts of cloud computing
3 Understand the concepts of block chain, cryptocurrencies, smart contracts
4 Understand design principles, tools, trends in 3 D printing and drones
5 Understand augmented reality (AR), virtual reality (VR), 5G technology, brain computer interface and human brain

Unit 1 Internet of Things

1.1 What is the Internet of Things? 1.2 Sensors, their types and features 1.3 IoT components: layers 1.4 Smart Cities 1.5 Industrial Internet of Things

Unit 2 Cloud Computing

2.1 Cloud Computing : it's nature and benefits 2.2 AWS 2.3 Google 2.4 Microsoft 2.5 Vendor Offering - IBM

Unit 3 Blockchain

3.1 What is Blockchain? Fundamentals 3.2 Principles and Technologies 3.3 Cryptocurrencies 3.4 Smart Contracts 3.5 Blockchain Applications and use cases

Unit 4 Digital Manufacturing : 3D Printing & Drones

4.1 The history and survey of 3D Printing 4.2 Design Principles and Tools 4.3 Emerging Trends & Use Cases in 3D Printing 4.4 Introduction of Drones, Engineering Disciplines
4.5 Multirotor Drone Assembly Course /Regulations and procedures for becoming a drone pilot

Unit 5 Future Trends

5.1 Augmented Reality (AR) and Virtual Reality (VR) 5.2 History, objective & global scenario of 5G Telecom 5.3 5G in India, Application and Use Cases 5.4 Brain Computer Interface, Application, Modal and Global Market 5.5 Brain Computer Interface and Human Brain

References Books:

IoT:

1. Internet of Things(IoT): Systems and Applications: Mehmet R. Yuce, Jamil Y. Khan
2. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things: David Hanes, Patrick Grossetete, Gonzalo Salgueiro.
3. Designing the Internet of Things: McEwen, Adrian, Cassimally, Hakim.

Cloud Computing:

1. Mastering Cloud Computing: Foundations and Applications Programming Book by Christian Vecchiola, Rajkumar Buyya, and S. Thamarai Selvi
2. Cloud Computing – Concepts, Technology and Architecture Pearson Thomas Erl
3. Cloud Computing Master the Concepts, Architecture and Applications with Realworld examples and Case studies By Ruchi Doshi, Temitayo Fagbola, Mehul Mahrishi.

Blockchain:

1. Block Chain: Blueprint for a New Economy, O'Reilly, Melanie Swan

2. Blockchain Basics: A Non-Technical Introduction in 25 Steps by: Daniel Drescher.

Digital Manufacturing:

1. Designing Reality: How to Survive and Thrive in the Third Digital Revolution by Prof. Niel Gershenfeld.
2. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing by Ian Gibson.
3. Build a Drone: A Step-by-Step Guide to Designing, Constructing, and Flying Your Very Own Drone by Barry Davies.

Future Trends:

1. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
2. Doug A Bowman, Ernest Kuijff, Joseph J La Viola, Jr and Ivan Poupyrev, “3D User Interfaces, Theory and Practice”, Addison Wesley, USA, 2005.
3. Simon Haykin, “Communication Systems”, 4th Edition, Wiley India

BT-110
SOFT SKILLS-I

Course Outcome:

- Students will be enabled to **understand** the correct usage of grammar.
- Students will **apply** the fundamental inputs of communication skills in making speech delivery, individual conference, and group communication.
- Students will **evaluate** the impact of interpersonal communication on their performance as a professional and in obtaining professional excellence at the workplace.
- Skills and techniques of persuasion and negotiation would **enhance** the level of students at multifarious administrative and managerial platforms.
- Student will be able to **equip** with basics of communication skills and will **apply** it for practical and oral purposes by being honed up in presentation skills and voice-dynamics.

UNIT I- Basics of Applied Grammar and usage

Tenses: Part of Speech, Active & Passive Voice, Articles, Subject-verb agreement, Antonyms, Synonyms, Prefix and Suffix, Narration, Conditional sentences, Concord, Tag questions, punctuation marks.

UNIT II- Presentation and Interaction Skills

Speech Delivery, Interjecting: Objectives& Methodology; Group Discussion: Objectives & Methods; Theme Presentation: Methods; Argumentative skills: Pattern and Ingredients; Debate & Discussion: Unity, Coherence & Emphasis. Public Speaking: Audience Analysis: Approach and Style. Interviews: Types; Focus & Objectives.

UNIT III- Interpersonal Communication Skills

Features: Methods; Principles; Requisites; Team- work; Skills: Empathy, Emotional Intelligence, empathy and listening skills. Time Management; Attitude; Responsibility. Leadership qualities: Integrity; Values; Trust; Self- Confidence & Courage; Communication and Networking; Speed reading; Problem Solving & Trouble- Shooting

UNIT IV- Persuasion and Negotiation Skills

Definition; Understanding Attitude, Beliefs, Values and Behavior; The process of Persuasion: Analysis of Audience; Classification of Audience; Egoistic and Non-Egoistic; Specific Techniques for Specific Audience; Skills of Persuasion, Steps to Persuasion/Influence, Negotiation: Definition; Process of Negotiation: Characteristics; Qualities of good negotiator; Approaches to Negotiation.

UNIT V- Communication Skills

Introduction to oral communication, Nuances & Modes of Speech Delivery, Public speaking: confidence, clarity, and fluency, Non verbal Communication: Kinesics, Paralinguistic features of Voice-Dynamics, Proxemics, Chronemics, and Presentation Strategies: planning, preparation, organization, delivery.

Prescribed Books:

1. **Technical Communication, (Second Ed.); O.U.P.,** Meenakshi Raman & S.Sharma New Delhi, 2011
2. **Business Communication for Managers**, Payal Mehra, Pearson, Delhi, 2012.

3. **Personality Development,** Harold R. Wallace et. al, Cengage Learning India Pvt. Ltd; New Delhi 2006
4. **Practical Communication** by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013,Delhi.
5. **Personality Development & Soft Skills,** Barun K.Mitra, Oxford University Press, New Delhi, 2012.
6. **Public Speaking,** William S. Pfeiffer, Pearson, Delhi, 2012.
7. **Human Values,** A.N. Tripathi, New Age International Pvt. Ltd. Publishers New Delhi ,2005

BT-210
SOFT SKILLS-II

Course Outcome:

- Students will be able to **converse** well with effective LSRW skills in English.
- Students will **evaluate** the importance of conversation in their personal and professional domain and **apply** it for extending their professional frontiers.
- Students will learn to **apply** motivation skills for their individual and professional excellence.
- Students will **utilize** their teamwork and their interpersonal communication skills to survive and excel at their work-place.
- Students will learn to **evaluate** creativity for their professional innovation and critical thinking for their competence.

UNIT I- LSRW Skills

Active Listening: Meaning and Art of Listening, Pronunciation, Tongue-Twisters, Stress in English Language,\ Reading style: Skimming; Scanning; Churning & Assimilation, Effective writing tools, Writing: Methods: Inductive; Deductive; Exposition; Linear; Interrupted; Spatial & Chronological etc

UNIT II- Conversational& Social Skills

Definition of Conversation; Speech and Conversation: Distinction; Listening and Conversation; Sustaining Interest; Rules of Conversation; Conversation and Personality; Importance of Conversation: Competence Relationships; Social Skills: Role of Communication; Purposeful Socializing; Attributes: Effective Communication; Conflict Resolution;; Relationship Management; Respect; Improvement Techniques: Feedback;
Goal Setting; Affording Resources; Adopting Interpersonal Skills; Importance.

UNIT III- Motivation Skills

Motivation: Definition; Sources of Motivation: Initiative; Willingness To Work; Eagerness to take on Work; Initiative; Learning Ability; Going Extra Miles; Learning And Analysis; Motivating Others: Techniques; One To One Correspondence; Understanding; Individual Motivation; Mobilizing Optimal Performance; Praise and Compliment; Goal Setting for Individual Employee; Individual Cultivation of Skills; Facilitating Active Involvement; Trust in the Working Hands.

UNIT IV- Work-Place Skills

Managing Stress; Techniques: Application of 4 A's; Avoid; Alter; Access; Adapt; Resilience: Flexibility in Thought and Behavior; Tolerance and Self-Belief; Team-Work and Communication; Compassion in Leadership; Communication Skills; Listening and Responding; Speaking Skills; Positive Thinking: Controlling Mind.

UNIT V- Creativity and Critical Thinking

Creativity: Definition; Characteristics of Creative Person: Fluency; Originality; Curiosity; Critical Thinking: Definition; Abilities: Discerning Facts and Claims; Credibility Analysis; Identifying Valid Reasons; Distinguishing Relevant from Irrelevant Fact/Claims; Detecting Bias; Knowing the Hidden Motives; Creative Methods; Features.

Prescribed Books:

1. **Technical Communication, (Second Ed.); O.U.P.,** Meenakshi Raman &S.Sharma New Delhi, 2011
2. **Personality Development,** Harold R. Wallace et. al, Cengage Learning India Pvt. Ltd; New Delhi 2006
3. **Personality Development & Soft Skills,** Barun K. Mitra, Oxford University Press, New Delhi, 2012.
4. **Practical Communication** by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
5. **Developing Communication Skills:** by Krishna Mohan, Meera Banerji; McMillan India Ltd, Delhi,1990.
6. **Communication Skills for Engineers and Scientists:** Sangeeta Sharma et. al., THI Learning Pvt Ltd, New Delhi, 2011.
7. **Public Speaking,** William S. Pfeiffer, Pearson, Delhi, 2012.
8. **Human Values,** A.N. Tripathi, New Age International Pvt. Ltd. Publishers New Delhi ,2005.

BT-303
Electronics Devices

3L:1T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Understand the principles of semiconductor Physics.

2. Understand and utilize the mathematical models of semiconductor junctions.

3. Understand carrier transport in semiconductors and design resistors.

4. Utilize the mathematical models of MOS transistors for circuits and systems.

5. Analyse and find application of special purpose diodes.

Unit I

Introduction to semiconductor physics: Review of quantum mechanics, electrons in periodic lattices, E-k diagrams. 8

Unit II

Energy bands in intrinsic and extrinsic silicon, carrier transport, diffusion current, drift current, mobility and resistivity, sheet resistance, design of resistors. 8

Unit III

Generation and recombination of carriers, Poisson and continuity equation P-N junction characteristics, I-V characteristics, and small signal switching models. 8

Unit IV

Avalanche breakdown, Zener diode, Schottky diode, Bipolar Junction Transistor, I-V characteristics, Ebers-Moll model. 8

Unit V

MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal **models of MOS transistor, LED, photodiode and solar cell. 8**

Text /Reference Books:

1. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson, 2014. 2. D. Neamen , D. Biswas, "Semiconductor Physics and Devices," McGraw-Hill Education.

3. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley &Sons, 2006.

4. C.T. Sah, “Fundamentals of Solid State Electronics,” World Scientific Publishing Co. Inc, 1991. 5. Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor,” Oxford univ. press, 2011.

6. Muhammad H. Rashid, “Electronic Devices and Circuits,” Cengage publication, 2014

BT-301

Digital System Design

3L:1T:0P

Course outcomes:

At the end of this course students will demonstrate the ability to:

1. Design and analyze combinational logic circuits.

2. Design and analyze modular combinational circuits with MUX / DEMUX, Decoder & Encoder

3. Design & analyze synchronous sequential logic circuits

4. Analyze various logic families.

5. Design ADC and DAC and implement in amplifier, integrator, etc.

Unit I

Logic simplification and combinational logic design: Binary codes, code conversion, review of Boolean algebra and Demorgans theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, tabulation method. 8

Unit II

MSI devices like comparators, multiplexers, encoder, decoder, driver & multiplexed display, half and full adders, subtractors, serial and parallel adders, BCD adder, barrel shifter and ALU. 8

Unit III

Sequential logic design: Building blocks like S-R, JK and Master-Slave JK FF, edge triggered FF, state diagram, state reduction, design of sequential circuits, ripple and synchronous counters, shift registers, finite state machines, design of synchronous FSM, algorithmic state machines charts. Designing synchronous circuits like pulse train generator, pseudo random binary sequence generator, clock generation. 8

Unit IV

Logic families and semiconductor memories: TTL NAND gate, specifications, noise margin, propagation delay, fan-in, fan-out, tristate TTL, ECL, CMOS families and their interfacing,

memory elements, concept of programmable logic devices like FPGA, logic implementation using programmable devices.

8

Unit V

Digital-to-Analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. analog-to-digital converters (ADC): single slope, dual slope, successive approximation, flash etc. switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc. 8

Text/Reference Books:

1. R.P. Jain, "Modern Digital Electronics," Tata McGraw Hill, 4th edition, 2009.

2. A. Anand Kumar, "Fundamental of Digital Circuits," PHI 4th edition, 2018.

3. W.H. Gothmann, "Digital Electronics- An Introduction to Theory and Practice," PHI, 2nd edition, 2006.

4. D.V. Hall, "Digital Circuits and Systems," Tata McGraw Hill, 1989.

5. A. K. Singh, "Foundation of Digital Electronics & Logic Design," New Age Int. Publishers.

6. Subrata Ghosal, "Digital Electronics," Cengage publication, 2nd edition, 2018

BT-302

Network Analysis and Synthesis

3L:0T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Understand basics electrical circuits with nodal and mesh analysis.

2. Appreciate electrical network theorems.

3. Apply Laplace transform for steady state and transient analysis.

4. Determine different network functions.

5. Appreciate the frequency domain techniques.

Unit I

Node and mesh analysis, matrix approach of network containing voltage & current sources and reactances, source transformation and duality.
8

Unit II

Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power transfer, compensation and Tallegen's theorem as applied to A.C. circuits.
8

Unit III Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to nonsinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.
8

Unit IV Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.
8

Unit V Transient behaviour, concept of complex frequency, driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and two four port network and interconnections, behaviour of series and parallel resonant circuits, introduction to band pass, low pass, high pass and band reject filters. 8

Text/Reference Books

1. Franklin F. Kuo, "Network Analysis and Synthesis," Wiley India Education, 2nd Ed., 2006.

2. Van, Valkenburg, "Network analysis," Pearson, 2019.

3. Sudhakar, A., Shyammohan, S. P., "Circuits and Network," Tata McGraw-Hill New Delhi, 1994.

4. A William Hayt, "Engineering Circuit Analysis," 8th Edition, McGraw-Hill Education.

5. A. Anand Kumar, "Network Analysis and Synthesis," PHI publication, 2019. to Modern Network Synthesis",Wiley Eastern Ltd.

BT-401

Communication Engineering

3L:0T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth.

2. Analyze the behavior of a communication system in presence of noise.

3. Investigate pulsed modulation system and analyze their system performance.

4. Investigate various multiplexing techniques.

5. Analyze different digital modulation schemes and compute the bit error performance.

Unit I Review of signals and systems, frequency domain representation of signals, principles of amplitude modulation systems- DSB, SSB and VSB modulations. 8

Unit II Angle modulation, representation of FM and PM signals, spectral characteristics of angle modulated signals. 8

Unit III Review of probability and random process, Gaussian and white noise characteristics, noise in amplitude modulation systems, noise in frequency modulation systems, pre-emphasis and de-emphasis, threshold effect in angle modulation. 8

Unit IV Pulse modulation, sampling process, pulse amplitude and pulse code modulation (PCM), differential pulse code modulation. Delta modulation, noise considerations in PCM, time division multiplexing, digital multiplexers.8

Unit V Digital modulation schemes- phase shift keying, frequency shift keying, quadrature amplitude modulation, continuous phase modulation and minimum shift keying. 8

Text/Reference Books:

1. Haykin S., "Communications Systems," John Wiley and Sons, 2001.

2. Proakis J. G. and Salehi M., "Communication Systems Engineering," Pearson Education, 2002.

3. Taub H. and Schilling D.L., "Principles of Communication Systems," Tata McGraw Hill, 2001.

4. Wozencraft J. M. and Jacobs I. M., "Principles of Communication Engineering," John Wiley, 1965.

5. Barry J. R., Lee E. A. and Messerschmitt D. G., "Digital Communication," Kluwer Academic Publishers, 2004.

6. Proakis J.G., "Digital Communications',' 4th Edition, McGraw Hill, 2000.

7. Abhay Gandhi, "Analog and Digital Communication," Cengage publication, 2015.

BT-402

Analog Circuits

3L:1T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Understand the characteristics of diodes and transistors.

2. Design and analyze various rectifier and amplifier circuits.

3. Design sinusoidal and non-sinusoidal oscillators

4. Understand the functioning of OP-AMP and design OP-AMP based circuits.

5. Design LPF, HPF, BPF, BSF.

Unit I

Diode circuits, amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers. 8

Unit II

High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier, various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues, feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin. 8

Unit III

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators.

Unit IV

Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load, differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR, Op-Amp design: Design of differential amplifier for a given specification, design of gain stages and output stages, compensation.

Unit V

Op-Amp applications: Review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications, active filters: Low pass, high pass, band pass and band stop, design guidelines. 8

Text/Reference Books:

1. J.V. Wait, L.P. Huelsman and GA Korn, "Introduction to Operational Amplifier theory and applications," Mc Graw Hill, 1992.

2. J. Millman and A. Grabel, "Microelectronics," 2nd edition, McGraw Hill, 1988.

3. P. Horowitz and W. Hill, "The Art of Electronics," 2nd edition, Cambridge University Press, 1989.

4. A.S. Sedra and K.C. Smith, "Microelectronic Circuits," Saunder's College11 Publishing, 4 th edition.

5. Paul R. Gray and Robert G. Meyer, "Analysis and Design of Analog Integrated Circuits," John Wiley, 3rd edition.

6. Muhammad H. Rashid, "Electronic Devices and Circuits," Cengage publication, 2014.

BT-403

Signal System

3L:1T:0P

Course outcomes:

At the end of this course students will demonstrate the ability to:

1. Analyze different types of signals.

2. Analyze linear shift-invariant (LSI) systems.

3. Represent continuous and discrete systems in time and frequency domain using Fourier series and transform.

4. Analyze discrete time signals in z-domain.

5. Study sampling and reconstruction of a signal

Unit I Signals and systems as seen in everyday life, and in various branches of engineering and science, energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals, system properties: linearity, additivity and homogeneity, shift-invariance, causality, stability, realizability. 8

Unit II Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input-output behaviour with aperiodic convergent inputs, characterization of causality and stability of linear shift invariant systems, system representation through differential equations and difference equations, Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response 8

Unit III Fourier series representation, Fourier transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality , Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier transform (DFT), Parseval's Theorem, the idea of signal space and orthogonal bases, the Laplace transform, notion of Eigen functions of LSI systems, a basis of Eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behaviour. 8

Unit IV The z-Transform for discrete time signals and systems-Eigen functions, region of convergence, z-domain analysis. 8

Unit V The sampling theorem and its implications- spectra of sampled signals, reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on, aliasing and its effects, relation between continuous and discrete time systems. 8

Text/Reference books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems," Pearson, 2015.

2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete," 4th edition, Prentice Hall, 1998.

3. B.P. Lathi, "Signal Processing and Linear Systems," Oxford University Press, 1998.

4. Douglas K. Lindner, "Introduction to Signals and Systems," McGraw Hill International Edition: 1999.

5. Simon Haykin, Barry van Veen, "Signals and Systems," John Wiley and Sons (Asia) Private Limited, 1998.

6. V. Krishnaveni, A. Rajeswari, “"Signals and Systems," Wiley India Private Limited, 2012.

7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems," John Wiley and Sons, 1995.

8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB," TMH, 2003.

9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems," TMH New Delhi, 2001. 10. A. Anand Kumar, “Signals and Systems,” PHI 3rd edition, 2018.

11. D. Ganesh Rao, K.N. Hari Bhat, K. Anitha Sheela, “Signal, Systems, and Stochastic Processes,” Cengage publication, 2018..

BT-305/405

Mathematics-IV

3—1—0

Course Outcomes

The students will learn:

The idea of partial differentiation and types of partial differential

The idea of classification of second partial differential equations, wave , heat equation and transmission lines

The basic ideas of statistics including measures of central tendency, correlation, regression and their properties.

The idea s of probability and random variables and various discrete and continuous probability distributions and their properties.

The statistical methods of studying data samples, hypothesis testing and statistical quality control, control charts and their properties.

Module I: Partial Differential Equations Origin of Partial Differential Equations, Linear and Non Linear Partial Equations of first order, Lagrange's Equations, Charpit's method, Cauchy's method of Characteristics, Solution of Linear Partial Differential Equation of Higher order with constant coefficients, Equations reducible to linear partial differential equations with constant coefficients.

Module II: Applications of Partial Differential Equations: Classification of linear partial differential equation of second order, Method of separation of variables, Solution of wave and heat conduction equation up to two dimension, Laplace equation in two dimensions, Equations of Transmission lines.

Module III: Statistical Techniques I: Introduction: Measures of central tendency, Moments, Moment generating function (MGF) , Skewness, Kurtosis, Curve Fitting , Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Exponential curves ,Correlation and Rank correlation, Regression Analysis: Regression lines of y on x and x on y, regression coefficients, properties of regressions coefficients and non linear regression.

Module IV: Statistical Techniques II: Probability and Distribution: Introduction, Addition and multiplication law of probability, Conditional probability, Baye's theorem, Random variables (Discrete and Continuous Random variable) Probability mass function and Probability density

function, Expectation and variance, Discrete and Continuous Probability distribution: Binomial, Poission and Normal distributions.

Module V: Statistical Techniques III: Sampling, Testing of Hypothesis and Statistical Quality Control: Introduction , Sampling Theory (Small and Large) , Hypothesis, Null hypothesis, Alternative hypothesis, Testing a Hypothesis, Level of significance, Confidence limits, Test of significance of difference of means, T-test, F-test and Chi-square test, One way Analysis of Variance (ANOVA).Statistical Quality Control (SQC) , Control Charts , Control Charts for variables (X and R Charts), Control Charts for Variables (p, np and C charts).

Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley & Sons, 2006.

2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003(Reprint).

3. S. Ross: A First Course in Probability, 6th Ed., Pearson Education India, 2002.

4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

Reference Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
2.T.Veerarajan : Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi.

3. R.K. Jain and S.R.K. Iyenger: Advance Engineering Mathematics; Narosa Publishing House, New Delhi.

4. J.N. Kapur: Mathematical Statistics; S. Chand & Sons Company Limited, New Delhi.

5. D.N.Elhance,V. Elhance & B.M. Aggarwal: Fundamentals of Statistics; Kitab Mahal Distributers, New Delhi.

BT-304/ BT-404

Technical Communication

Course Outcomes

1.Students will be enabled to understand the nature and objective of Technical Communication relevant for the work place as Engineers.

2. Students will utilize the technical writing for the purposes of Technical Communication and its exposure in various dimensions.

. Students would imbibe inputs by presentation skills to enhance confidence in face of diverse audience.

4. Technical communication skills will create a vast know-how of the application of the learning to promote their technical competence.

5. It would enable them to evaluate their efficacy as fluent & efficient communicators by learning the voice-dynamics

Unit -1 Fundamentals of Technical Communication: L T P 2 1 0 Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication; Dimensions of Communication: Reading & comprehension; Technical writing: sentences; Paragraph; Technical style: Definition, types & Methods; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication.

Unit - II Forms of Technical Communication: Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; Expert Technical Lecture: Theme clarity; Analysis & Findings; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration, C.V./Resume writing; Technical Proposal: Types, Structure & Draft.

Unit - III Technical Presentation: Strategies & Techniques Presentation: Forms; interpersonal Communication; Class room presentation; style; method; Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

Unit - IV Technical Communication Skills: Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Nuances: Exposition narration & Description; effective business communication competence: Grammatical; Discourse competence: combination of expression & conclusion; Socio-linguistic competence: Strategic competence: Solution of communication problems with verbal and non verbal means.

Unit - V Dimensions of Oral Communication & Voice Dynamics: Code and Content; Stimulus & Response; Encoding process; Decoding process; Pronunciation Etiquette; Syllables; Vowel sounds; Consonant sounds; Tone: Rising tone; Falling Tone; Flow in Speaking; Speaking with a purpose; Speech & personality; Professional Personality Attributes: Empathy; Considerateness; Leadership; Competence.

Reference Books 1.

Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.

2. Personality Development and Soft Skills by Barun K. Mitra, OUP, 2012, New Delhi.

3. Spoken English- A Manual of Speech and Phonetics by R.K.Bansal & J.B.Harrison, Orient Blackswan, 2013, New Delhi.

4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.

5. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.

6. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S. 7. A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.

8. Skills for Effective Business Communication by Michael Murphy, Harward University, U.S.

9. Business Communication for Managers by Payal Mehra, Pearson Publication, Delhi.

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BT-314/ BT-414

Universal Human Values and Professional Ethics

L 3 T 0 P 0

Course Outcome:

On completion of this course, the students will be able to

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society

2. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.

3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society

4. Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.

5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

UNIT-1 Course Introduction - Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT-2 Understanding Harmony in the Human Being - Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and

harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT-3 Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in societyUndivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!.

UNIT-4 Understanding Harmony in the Nature and Existence - Whole existence as Co-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT-5 Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, 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, technologies and management models, Case studies of typical holistic technologies, management models and production systems, 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.

Text Books:

- R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA

2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.

3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books

. 5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.

6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

7. A N Tripathy, 2003, Human Values, New Age International Publishers.

8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.

9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press

10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books. 1

2. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

BT-309/ BT-409

COMPUTER SYSTEM SECURITY

Course Outcome

At the end of course , the student will be able to understand

1 To discover software bugs that pose cyber security threats and to explain how to fix the bugs to mitigate such threats

2 To discover cyber attack scenarios to web browsers and web servers and to explain how to mitigate such threats

3 To discover and explain mobile software bugs posing cyber security threats, explain and recreate exploits, and to explain mitigation techniques.

4 To articulate the urgent need for cyber security in critical computer systems, networks, and world wide web, and to explain various threat scenarios

5 To articulate the well known cyber attack incidents, explain the attack scenarios, and explain mitigation techniques

Unit I Computer System Security Introduction: Introduction, What is computer security and what to l earn? , Sample Attacks, The Marketplace for vulnerabilities, Error 404 Hacking digital India part 1 chase. Hijacking & Defense: Control Hijacking ,More Control Hijacking attacks integer overflow ,More Control Hijacking attacks format string vulnerabilities, Defense against Control Hijacking - Platform Defenses, Defense against Control Hijacking - Run-time Defenses, Advanced Control Hijacking attacks. 08

Unit II Confidentiality Policies: Confinement Principle ,Detour Unix user IDs process IDs and privileges , More on confinement techniques ,System call interposition ,Error 404 digital Hacking in India part 2 chase , VM based isolation ,Confinement principle ,Software fault isolation , Rootkits ,Intrusion Detection Systems

Unit III Secure architecture principles isolation and leas: Access Control Concepts , Unix and windows access control summary ,Other issues in access control ,Introduction to browser isolation . Web security landscape : Web security definitions goals and threat models , HTTP content rendering .Browser isolation .Security interface , Cookies frames and frame busting, Major web server threats ,Cross site request forgery ,Cross site scripting ,Defenses and protections against XSS , Finding vulnerabilities ,Secure development. 08

Unit IV Basic cryptography: Public key cryptography ,RSA public key crypto ,Digital signature Hash functions ,Public key distribution ,Real world protocols ,Basic terminologies ,Email security certificates ,Transport Layer security TLS ,IP security , DNS security. 08

Unit V Internet Infrastructure: Basic security problems , Routing security ,DNS revisited ,Summary of weaknesses of internet security ,.Link layer connectivity and TCP IP connectivity , Packet filtering firewall ,Intrusion detection. 08

Text books:

1. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010.

2. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.

3. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010.

4. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press, 2001. Mapped With : https://ict.iitk.ac.in/product/computer-system-security/

BT-310/ BT-410

PYTHON PROGRAMMING

Course Outcome

At the end of course , the student will be able to understand

1 To read and write simple Python programs.

2 To develop Python programs with conditionals and loops.

3 To define Python functions and to use Python data structures –- lists, tuples, dictionaries

4 To do input/output with files in Python

5 To do searching ,sorting and merging in Python

Unit I Introduction: The Programming Cycle for Python , Python IDE, Interacting with Python Programs , Elements of Python, Type Conversion. Basics: Expressions, Assignment Statement, Arithmetic Operators, Operator Precedence, Boolean Expression. 08

Unit II Conditionals: Conditional statement in Python (if-else statement, its working and execution), Nested-if statement and Elif statement in Python, Expression Evaluation & Float Representation. Loops: Purpose and working of loops , While loop including its working, For Loop , Nested Loops , Break and Continue. 08

Unit III Function: Parts of A Function , Execution of A Function , Keyword and Default Arguments ,Scope Rules. Strings : Length of the string and perform Concatenation and Repeat operations in it. Indexing and Slicing of Strings. Python Data Structure : Tuples , Unpacking Sequences , Lists , Mutable Sequences , List Comprehension , Sets , Dictionaries Higher Order Functions: Treat functions as first class Objects , Lambda Expressions

Unit IV Sieve of Eratosthenes: generate prime numbers with the help of an algorithm given by the Greek Mathematician named Eratosthenes, whose algorithm is known as Sieve of Eratosthenes. File I/O : File input and output operations in Python Programming Exceptions and Assertions Modules : Introduction , Importing Modules , Abstract Data Types : Abstract data types and ADT interface in Python Programming. Classes : Class definition and other operations in the classes , Special Methods (such as _init_, _str_, comparison methods and Arithmetic methods etc.) , Class Example , Inheritance , Inheritance and OOP.

Unit V Iterators & Recursion: Recursive Fibonacci , Tower Of Hanoi Search : Simple Search and Estimating Search Time , Binary Search and Estimating Binary Search Time Sorting & Merging: Selection Sort , Merge List , Merge Sort , Higher Order Sort 08

Text books:

- Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
- Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
- 3.John V Guttag, ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2013
- 4.Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
- 5.Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
- 6.Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
- 7.Charles Dierbach, ―Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition, 2013.
- 8.Paul Gries, Jennifer Campbell and Jason Montojo, ―Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

BT-501

INTEGRATED CIRCUITS

3L:1T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Explain complete internal analysis of Op-Amp 741-IC.

2. Examine and design Op-Amp based circuits and basic components of ICs such as various types of filter.

3. Implement the concept of Op-Amp to design Op-Amp based non-linear applications and wave-shaping circuits.

4. Analyse and design basic digital IC circuits using CMOS technology.

5. Describe the functioning of application specific ICs such as 555 timer ,VCO IC 566 and PLL.

Unit I The 741 IC Op-Amp: General operational amplifier stages (bias circuit, the input stage, the second stage, the output stage, short circuit protection circuitry), device parameters, DC and AC analysis of input stage, second stage and output stage, gain, frequency response of 741, a simplified model, slew rate, relationship between ft and slew rate. 8

Unit II Linear Applications of IC Op-Amps: Op-Amp based V-I and I-V converters, instrumentation amplifier, generalized impedance converter, simulation of inductors. Active Analog filters: Sallen Key second order filter, Designing of second order low pass and high pass Butterworth filter, Introduction to band pass and band stop filter, all pass active filters, KHN Filters. Introduction to design of higher order filters. 8

Unit III Frequency Compensation & Nonlinearity: Frequency Compensation, Compensation of two stage Op-Amps, Slewing in two stage Op-Amp. Nonlinearity of Differential Circuits, Effect of Negative feedback on Nonlinearity. Non-Linear Applications of IC Op-Amps: Basic Log–Anti Log amplifiers using diode and BJT, temperature compensated Log-Anti Log amplifiers using diode, peak detectors, sample and hold circuits. Op-amp as a comparator and zero crossing detector, astable multivibrator & monostable multivibrator. Generation of triangular waveforms, analog multipliers and their applications. 4 8

Unit IV Digital Integrated Circuit Design: An overview, CMOS logic gate circuits basic structure, CMOS realization of inverters, AND, OR, NAND and NOR gates. Latches and Flip flops: the latch, CMOS implementation of SR flip-flops, a simpler CMOS implementation of the clocked SR flip-flop, CMOS implementation of J-K flipflops, D flip- flop circuits. 6

Unit V Integrated Circuit Timer: Timer IC 555 pin and functional block diagram, Monostable and Astable multivibrator using the 555 IC. Voltage Controlled Oscillator: VCO IC 566 pin and functional block diagram and applications. Phase Locked Loop (PLL): Basic principle of PLL, block diagram, working, Ex-OR gates and multipliers as phase detectors, applications of PLL. 6

Text Book:

1. Microelectronic Circuits, Sedra and Smith, 7th Edition, Oxford, 2017.

2. Behzad Razavi: Design of Analog CMOS Integrated Circuits, TMH

Reference Books:

1. Gayakwad: Op-Amps and Linear Integrated Circuits, 4th Edition Prentice Hall of India, 2002.
2. Franco, Analog Circuit Design: Discrete & Integrated, TMH, 1st Edition.

3. Salivahnan, Electronics Devices and Circuits, TMH, 3rd Edition, 2015

4. Millman and Halkias: Integrated Electronics, TMH, 2nd Edition, 2010

BT-502

MICROPROCESSOR & MICROCONTROLLER

3L:1T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Demonstrate the basic architecture of 8085.

2. Illustrate the programming model of microprocessors & write program using 8085 microprocessor.

3. Demonstrate the basics of 8086 Microprocessor and interface different external Peripheral Devices like timer, USART etc. with Microprocessor (8085/8086).

4. Compare Microprocessors & Microcontrollers, and comprehend the architecture of 8051 microcontroller

5. Illustrate the programming model of 8051 and implement them to design projects on real time problems.

Unit I Introduction to Microprocessor: Microprocessor architecture and its operations, Memory, Input & output devices, The 8085 MPU- architecture, Pins and signals, Timing Diagrams, Logic devices for interfacing, Memory interfacing, Interfacing output displays, Interfacing input devices, Memory mapped I/O. 8

Unit II Basic Programming concepts:, Flow chart symbols, Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Writing assembly language programs, Programming techniques: looping, counting and indexing. Additional data transfer and 16 bit arithmetic instruction, Logic operation: rotate, compare, counter and time delays, 8085 Interrupts. 8

Unit III 16-bit Microprocessors (8086): Architecture, Pin Description, Physical address, segmentation, memory organization, Addressing modes. Peripheral Devices: 8237 DMA

Controller, 8255 programmable peripheral interface, 8253/8254programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C. 8

Unit IV 8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM. 8051 Addressing Modes. 8

Unit V Assembly programming and instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. Programming 8051 Timers. Serial Port Programming, Interrupts Programming, Interfacing: LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation. 8

Text Books:

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 6th Edition, Penram International Publication (India) Pvt. Ltd.,2013

2. D. V. Hall : Microprocessors Interfacing, TMH 3rd Edition,

3. Mazidi Ali Muhammad, Mazidi Gillispie Janice, and McKinlay Rolin D., "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson, 2nd Edition,2006

Reference Books:

1. Kenneth L. Short, "Microprocessors and programmed Logic", 2nd Ed, Pearson Education Inc.,2003

2. Barry B. Brey, "The Intel Microprocessors, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, PentiumPro Processor, PentiumII, PentiumIII, Pentium IV, Architecture, Programming & Interfacing", Eighth Edition, Pearson Prentice Hall, 2009.

3. Shah Satish, "8051 Microcontrollers MCS 51 Family and its variants", Oxford,

BT-503

DIGITAL SIGNAL PROCESSING

3L:1T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Design and describe different types of realizations of digital systems (IIR and FIR) and their utilities.

2. Select design parameters of analog IIR digital filters (Butterworth and Chebyshev filters) and implement various methods such as impulse invariant transformation and bilinear transformation of conversion of analog to digital filters.

3. Design FIR filter using various types of window functions.

4. Define the principle of discrete Fourier transform & its various properties and concept of circular and linear convolution. Also, students will be able to define and implement FFT i.e. a fast computation method of DFT.

5. Define the concept of decimation and interpolation. Also, they will be able to implement it in various practical applications.

Unit I Introduction to Digital Signal Processing: Basic elements of digital signal processing, advantages and disadvantages of digital signal processing, Technology used for DSP. Realization of Digital Systems: Introduction- basic building blocks to represent a digital system, recursive and non-recursive systems, basic structures of a digital system: Canonic and Non-Canonic structures. IIR Filter Realization: Direct form, cascade realization, parallel form realization, Ladder structures- continued fraction expansion of H (z), example of continued fraction, realization of a ladder structure, design examples. FIR Filter Realization: Direct, Cascade, FIR Linear Phase Realization and design examples. 8

Unit II Infinite Impulse Response Digital (IIR) Filter Design: Introduction to Filters, Impulse Invariant Transformation, Bi-Linear Transformation, All- Pole Analog Filters: Butterworth and Chebyshev, Design of Digital Butterworth and Chebyshev Filters, Frequency Transformations. 8

Unit III Finite Impulse Response Filter (FIR) Design: Windowing and the Rectangular Window, Gibb's phenomenon, Other Commonly Used Windows (Hamming, Hanning, Bartlett, Blackmann, Kaiser), Examples of Filter Designs Using Windows. Finite Word length effects in digital filters: Coefficient quantization error, Quantization noise – truncation and rounding, Limit cycle oscillations-dead band effects. 8

Unit IV DFT & FFT: Definitions, Properties of the DFT, Circular Convolution, Linear Convolution using Circular Convolution, Decimation in Time (DIT) Algorithm, Decimation in Frequency (DIF) Algorithm. 8

Unit V Multirate Digital Signal Processing (MDSP): Introduction, Decimation, Interpolation, Sampling rate conversion: Single and Multistage, applications of MDSP- Subband Coding of Speech signals, Quadrature mirror filters, Advantages of MDSP. 8

Text Books:

1. John G Prokias, Dimitris G Manolakis, Digital Signal Processing. Pearson , 4th Edition, 2007

2. Johnny R. Johnson, Digital Signal Processing, PHI Learning Pvt Ltd., 2009.

3. S. Salivahanan, A. Vallavaraj, Digital Signal Processing, TMH, 4th Edition 2017.

4. Oppenheim & Schafer, Digital Signal Processing. Pearson Education 2015

5. S.K. Mitra, 'Digital Signal Processing–A Computer Based Approach, TMH, 4th Edition.

BT-504

VLSI TECHNOLOGY

3L:0T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Interpret the basics of crystal growth, wafer preparation and wafer cleaning.
2. Evaluate the process of Epitaxy and oxidation.
3. Differentiate the lithography, etching and deposition process.
4. Analyze the process of diffusion and ion implantation
5. Express the basic process involved in metallization and packaging

Unit I

Introduction To IC Technology: SSI, MSI, LSI, VLSI Integrated Circuits. Crystal Growth and Wafer Preparation: Electronic Grade Silicon, Czochralski Crystal Growth, Silicon Shaping, Processing Considerations. Wafer Cleaning Technology - Basic Concepts, Wet cleaning, Dry cleaning

8

Unit II

Epitaxy: Vapor-Phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation.

Oxidation: Growth Kinetics, Thin Oxides, Oxidation Techniques and Systems, Oxides Properties.

8

Unit III

Lithography: Optical Lithography, Electron beam lithography, Photo masks, Wet Chemical Etching.

Dielectric and Polysilicon Film Deposition: Deposition Processes of Polysilicon, Silicon Dioxide, Silicon Nitride.

8

Unit IV

Diffusion: Models of diffusion in solids, Fick's 1-Dimensional diffusion equation, Diffusion of Impurities in Silicon and Silicon Dioxide, Diffusion Equations, Diffusion Profiles, Diffusion Furnace, Solid, Liquid and Gaseous Sources,

Ion-Implantation: Ion-Implantation Technique, Range Theory, Implantation Equipment.

8

Unit V

Metallization: Metallization Application, Metallization Choices, Physical Vapor Deposition, Vacuum Deposition, Sputtering Apparatus.
Packaging of VLSI devices: Package Types, Packaging Design Consideration, VLSI Assembly Technologies, Package Fabrication Technologies, CMOS fabrication steps.

8

Text Books:

1. S. M. Sze, "VLSI Technology", McGraw Hill Publication, 2nd Edition 2017
2. S.K. Ghandhi, "VLSI Fabrication Principles", Willy-India Pvt. Ltd, 2008

Reference Books:

1. J. D. Plummer, M. D. Deal and Peter B. Griffin, “Silicon VLSI Technology: Fundamentals, Practice and Modeling", Pearson Education Publication, 2009
2. Stephen A. Campbell, "Fabrication Engineering at the Micro and Nano scale", Oxford University Press, 2013

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BT-505

ELECTRONIC SWITCHING

3L:0T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Describe the fundamentals of circuit switching and distinguish complex telephone systems.

2. Differentiate the fundamentals of Space division switching and time division switching.

3. Design, develop and evaluate the telecom traffic to meet defined specifications and needs.

4. Identify the control of switching networks and signalling concepts.

5. Classify the engineering concepts of packet switching and routing which will help to design various switch architectures for future research work

Unit I Evolution of switching systems: Introduction, Message switching, Circuits switching, Functions of a switching system, Register translatorsenders, Distribution frames, Crossbar switch, A general trucking, Electronic switching, Reed- electronic system, Digital switching systems. 8

Unit II Digital Switching: Switching functions, Space Division Switching, Time Division Switching, Two-Dimensional Switching, Digital CrossConnect Systems, Digital Switching in an Analog Environment. 8

Unit III Telecom Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking models and Loss Estimates, Delay Systems 8

Unit IV Control of switching systems: Introduction, Call-processing functions, Common control, Reliability, availability and security; Stored-program control. Signaling: Introduction, Customer line signaling, Audiofrequency junctions and trunk circuits, FDM carrier systems, PCM

signaling, Inter-register signalling, Common-channel signaling principles, CCITT signaling system no. 6 and 7, Digital customer line signaling. 8

Unit V Packet Switching: Packet Switching, Statistical Multiplexing, Routing Control (dynamic routing, virtual circuit routing and fixed-path routing), Flow Control, X.25, Frame Relay, TCP/IP ATM Cells, ATM Service Categories, ATM Switching (ATM Memory Switch, Space-Memory Switch, Memory-Space Switch, Memory-Space Memory switch, Banyan Network Switch, Clos Networks). 8

Text Book:

1. Thiagarajan Viswanathan & Manav Bhatnagar, "Telecommunication Switching Systems and Networks", PHI, 2018

2. J.E. Flood, "Telecommunication Switching, Traffic and Networks", Pearson Education 2016.
3. John C. Bellamy, "Digital Telephony", John Wiley, 3rd Ed, 2006.

BT-601

DIGITAL COMMUNICATION

3L:1T:0P

. Course Outcomes:

At the end of this course students will demonstrate the ability:

- To formulate basic statistics involved in communication theory.
- . To demonstrate the concepts involved in digital communication.
- 3. To explain the concepts of digital modulation schemes.
- 4. To analyze the performance of digital communication systems. 5
- . To apply the concept of information theory in digital systems

Unit I Random Variables: Concept of Probability, Random variables, Statistical averages, Random process, Power Spectral Density & Autocorrelation Function of Random Processes, Gaussian Random Process.

Unit II Digital Communication Basics: Introduction to Digital communication systems, PSD of Line Coding schemes, Pulse shaping, Scrambling, Eye diagram, Gram-Schmidt orthogonalization scheme. 8

Unit III Digital Modulation: Modulation and Demodulation of Digital modulation schemes-ASK, FSK, PSK, DPSK, QPSK. Constellation diagram, Introduction to M-ary communication. 8

Unit IV Digital Receiver: Optimum threshold detection, Concept of Matched Filters, BER analysis of BASK, BFSK, BPSK, Introduction of Spread spectrum communication (DS-SS, FH-SS).

Unit V Information Theory: Measure of information-information, entropy, mutual information, mutual entropy, Source encoding (Shannon-Fano, Huffman), Shannon's channel capacity theorem, Introduction to error correction and detection, Linear block codes, Cyclic codes (systematic, non-systematic), Convolution coding and decoding. 8

Text Books:

1. B.P. Lathi, "Modern Digital and Analog communication Systems", 4th Edition, Oxford University Press.

2. John G. Proakis, "Digital Communications", 5th Edition, TMH.

3. H. Taub, D L Schilling, Gautam Saha, "Principles of Communication", 4th Edition, TMH.

4. Singh & Sapray, Communication Systems, 3th Edition, TMH.

Reference Books:

1. Simon Haykin, "Communication Systems", 5th Edition, Wiley India.

2. (Schaum's Outline Series) H P HSU & D Mitra, "Analog and Digital Communications", TMH, 3rd Edition.

BT-602

Control System

3L:1T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Describe the basics of control systems along with different types of feedback and its effect. Additionally they will also be able to explain the techniques such as block diagrams reduction, signal flow graph and modelling of various physical systems along with modelling of DC servomotor.

2. Explain the concept of state variables for the representation of LTI system.

3. Interpret the time domain response analysis for various types of inputs along with the time domain specifications.

4. Distinguish the concepts of absolute and relative stability for continuous data systems along with different methods.

5. Interpret the concept of frequency domain response analysis and their specifications.

Unit I Introduction to Control Systems: Basic Components of a control system, Feedback and its effect, types of feedback control systems. Block diagrams Reduction and signal flow graphs, Modeling of Physical systems: electrical networks, mechanical systems elements, free body diagram, analogous Systems, sensors and encoders in control systems, modeling of armature controlled and field controlled DC servomotor.

Unit II State-Variable Analysis: Introduction, vector matrix representation of state equation, state transition matrix, state-transition equation, relationship between state equations and highorder differential equations, relationship between state equations and transfer functions, Decomposition of transfer functions, Controllability and observability, Eigen Value and Eigen Vector, Diagonalization.

Unit III Time domain Analysis of Control Systems: Time response of continuous data systems, typical test signals for the time response of control systems, unit step response and timedomain specifications, time response of a first order system, transient response of a prototype second order system, Steady-State error, Static and dynamic error coefficients, error analysis for different types of systems.

Unit IV Stability of Linear Control Systems: Bounded-input bounded-output stability continuous data systems, zero-input and asymptotic stability of continuous data systems, Routh Hurwitz criterion, Root-Locus Technique: Introduction, Properties of the Root Loci, Design aspects of the Root Loci. 8

UnitV Frequency Domain Analysis: Resonant peak and Resonant frequency, Bandwidth of the prototype Second order system, effects of adding a zero to the forward path, effects of adding a pole to the forward path, polar plot, Nyquist stability criterion, stability analysis with the Bode plot, relative stability: gain margin and phase margin. 8

Text Book:

1. I. J. Nagrath & M. Gopal, “Control System Engineering”, 6th Ed. New Age International Publishers, 2018

2. B.C. Kuo & Farid Golnaraghi, “Automatic Control Systems”, 9th Edition, John Wiley India, 2008

Reference Books:

1. (Schaums Outlines Series) Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, “Control Systems”, 3rd Edition, TMH, Special Indian Edition, 2010.

2. A. Anand Kumar, “Control Systems”, Second Edition, PHI Learning private limited, 2014.

3. William A. Wolovich, “Automatic Control Systems”, Oxford University Press, 2011.

BT-603

Antenna & Wave Propagation

3L:1T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Identify different coordinate systems and their applications in electromagnetic field theory to establish a relation between any two systems using the vector calculus.

2. Explain the concept of static electric field, current and properties of conductors.

3. Express the basic concepts of ground, space, sky wave propagation mechanism.

4. Demonstrate the knowledge of antenna fundamentals and radiation mechanism of the antenna.

5. Analyze and design different types of basic antennas.

Unit I Coordinate Systems and Transformation: Cartesian, Cylindrical, Spherical transformation. Vector calculus: Differential length, area and volume, line, surface and volume integrals, Del operator, Gradient, Divergence of a vector, Divergence theorem, Curl of a vector, Stokes's theorem, Laplacian of a scalar. 6

Unit II Electrostatic fields and Magnetostatic fields: Electric field intensity, Electric field due to charge distribution, Electric flux density, Gauss's Law- Maxwell's equation, Continuity equation and relaxation time, boundary conditions, Magneto-static fields, Ampere's circuit law, Maxwell's equation, magnetic scalar and vector potential, Magnetic boundary conditions, Maxwell's equation in final form. 10

Unit III Antenna fundamental and definitions: Introduction, Basic antenna parameters, Patterns, Beam area (or Beam solid angle) ΩA, Radiation intensity, Beam efficiency, Directivity D and Gain G, Directivity and resolution, Antenna apertures, Effective height, The radio communication link, Fields from oscillating dipole, Single-to-noise ratio (SNR), Antenna temperature, Antenna impedance. 8

Unit IV Antenna Design: Electric dipoles, The short electric dipole, The fields of a short dipole, Radiation resistance of short electric dipole, Thin linear antenna, Radiation resistance of λ/2 antenna, Array of two driven λ/2 elements: Broadside case and end-fire case, Horizontal antennas above a plane ground, Vertical antennas above a plane ground, Yagi-Uda antenna design, Longwire antennas, Folded dipole antennas. 8

Unit V Wave Propagation: Plane earth reflection, Space wave and surface wave. Space wave propagation: Introduction, Field strength relation, Effects of imperfect earth, Effects of curvature of earth. Sky wave propagation: Introduction structural, details of the ionosphere, Wave propagation mechanism, Refraction and reflection of sky waves by ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and skip distance, Relation between MUF and the skip distance, Multi-Hop propagation, Wave characteristics. 8

Text Books:

1. MNO Sadiku, “Elements of Electromagnetic’, 7th Ed, Oxford University Press, 2018.

2. John D Kraus, Ronald J Marhefka and Ahmad S. Khan, “Antennas and Wave Propagation”, 5th Edition, Tata McGraw Hill, 2017.

3. Das, Antennas and Wave Propagation, TMH 1st Edition.

4. C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley, 2016.

5. WH Hayt and JA Buck, “Engineering Electromagnetic”, 7th Edition TMH, 2013.

6. (Schaums Outlines Series) Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, “Engineering Electromagnetic”, 3rd Edition, TMH, Special Indian Edition, 2010.

BT-604

DATA COMMUNICATION NETWORKS

3L:0T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Identify the issues and challenges in the architecture of a network.

2. Analyze the services and features of various protocol layers in data layer.

3. Demonstrate the knowledge of multiple access to design a access technique for a particular application.

4. Realize protocols at different layers of a network hierarchy.

5. Recognize security issues in a network and various application of application layer.

Unit I Introduction to Networks & Data Communications: Goals and Applications of Networks ,The Internet, Protocols & Standards, Layered Tasks, OSI reference Model, TCP / IP, Addressing, Line Coding Review. 8

Unit II Physical Layer: Transmission Media- Guided and unguided, Network Topology Design, Data Link Layer: Error detection and Correction, Framing, Flow and Error Control Protocols, Noiseless Channel and Noisy Channel Protocol, HDLC, Point-to-Point Protocol 8

Unit III Multiple Access: RANDOH, CDMA, CSMA/CD, CSMA/CA, Controlled Access, Channelization Wired LANs: IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11, Bluetooth IEEE 802.16. 8 IV Network Layer: Design Issues. Routing Algorithms. Congestion control Algorithms. Internetworking –TCP/IP, IP

Packet, IPv4 and IPv6 Protocols, IPV4 Addresses, Connecting Devices, Virtual LAN IPV6 Addresses. 8

Unit V Transport Layer Protocol: UDP and TCP, ATM, Cryptography, Network Security, Session Layer-Design issues. Application Layer: File Transfer, Electronic mail, HTTP, WWW, SMTP, Cryptography, Network Security. 8

Text Books:

- B. A. Forouzan, "Data Communications and Networking", 5th Edition, TMH, 2017.

Reference Books:

1. S. Tanenbaum, "Computer Networks", 4th Edition, Pearson, 2013.

2. W. Stallings, "Data and Computer Communication", 8th Edition, Pearson, 2007.

BT-610

CONSTITUTION OF INDIA, LAW AND ENGINEERING

L:T: P:

2 0 :0

COURSE OUTCOME:

At the end of the course, learners should be able to

1. Identify and explore the basic features and modalities about Indian constitution.

2. Differentiate and relate the functioning of Indian parliamentary system at the center and state level.

3. Differentiate different aspects of Indian Legal System and its related bodies.

4. Discover and apply different laws and regulations related to engineering practices.

5. Correlate role of engineers with different organizations and governance models Pedagogy: Lecture, Problem based learning, Group discussions, Visual media, Films, Documentaries, Debate forums.

Module 1

Introduction and Basic Information about Indian Constitution: Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947,Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.

Module 2

-Union Executive and State Executive: Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.

Module 3

- Introduction and Basic Information about Legal System: The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.

Module 4-

Intellectual Property Laws and Regulation to Information: Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to InformationIntroduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.

Module 5

-Business Organizations and E-Governance: Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

Suggested Readings:

• Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.

• Granville Austin: The Indian Constitution: Cornerstone of a Nation (Classic Reissue), Oxford University Press.

• S.G Subramanian: Indian Constitution and Indian Polity, 2nd Edition, Pearson Education 2020.

• Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.

• Madhav Khosla: The Indian Constitution, Oxford University Press. •

PM Bakshi: The Constitution of India, Latest Edition, Universal Law Publishing.

• V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)

• Suresh T. Viswanathan: The Indian Cyber Laws, Bharat Law House, New Delhi-88

• P. Narayan: Intellectual Property Law, Eastern Law House, New Delhi

• Prabudh Ganguli: Gearing up for Patents: The Indian Scenario, Orient Longman.

• BL Wadehra: Patents, Trademarks, Designs and Geological Indications Universal Law Publishing - LexisNexis.

• Intellectual Property Rights: Law and Practice, Module III by ICSI (only relevant sections)

• Keshavanand Bharati V. State of Kerala, AIR 1973 SC 1461.

• Maneka Gandhi V. Union of India AIR, 1978 SC 597.

• S.R. Bammai V. Union of India, AIR 1994 SC 1918.

• Kuldip Nayyar V. Union of India, AIR 2006 SC312.

• A.D.M. Jabalpur V. ShivkantShakla, AIR 1976 SC1207.

• Remshwar Prasad V. Union of India, AIR 2006 SC980.

• Keshav Singh in re, AIR 1965 SC 745.

• Union of India V. Talsiram, AIR 1985 SC 1416.

• Atiabari Tea Estate Co.V. State of Assam, AIR 1961SC232.

• SBP & Co. Vs. Patel Engg. Ltd. 2005 (8) SCC 618.

• Krishna Bhagya Jala Nigam Ltd. Vs. G. Arischandra Reddy (2007) 2 SCC 720.

BT-509

INDIAN TRADITION, CULTURE AND SOCIETY

L: T:P:

2 : 0 :0

COURSE OUTCOMES:

Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

Module 1- Society State and Polity in India State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women. Four-class Classification, Slavery.

Module 2- Indian Literature, Culture, Tradition, and Practices Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali,Prakrit And Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature,Malayalam

Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature

Module 3- Indian Religion, Philosophy, and Practices Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.

Module 4-Science, Management and Indian Knowledge System Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India ,Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India ,Writing Technology in India Pyrotechnics in India Trade in Ancient India/,India's Dominance up to Pre-colonial Times

Module 5- Cultural Heritage and Performing Arts Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema

Suggested Text & Reference Books

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014

2. S. Baliyan, Indian Art and Culture, Oxford University Press, India

3. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan

4. Romila Thapar, Readings In Early Indian History Oxford University Press , India

5. Fritz of Capra, Tao of Physics

6. Fritz of Capra, The wave of Life

7. V N Jha (English Translation), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation,Velliarnad,Amaku,am

BT-703

VLSI Design

3L:0T:0P

. **Course Outcomes:**

At the end of this course students will demonstrate the ability to:

1. Express the concept of VLSI design and CMOS circuits and delay study.

2. Analyze mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits.

3. Design and analyze various combinational & sequential circuits based on CMOS technology.

4. Examine power logic circuits and different semiconductor memories used in present day technology.

5. Interpret faults in digital circuits, Fault Models and various Testing Methodologies.

Credits Unit Topics Lectures

Unit I Introduction: VLSI Design flow, general design methodologies; critical path and worst case timing analysis, overview of design hierarchy, layers of abstraction, integration density and

Moore's law, VLSI design styles, packaging, CMOS Logic, Propagation Delay definitions, sheet resistance. 8

Unit II Interconnect Parameters: Resistance, Inductance, and Capacitance, skin effect and its influence , lumped RC Model, the distributed RC Model, transient Response, RC delay model, Linear Delay Model, Logical Effort of Paths, Scaling. 8

Unit III Dynamic CMOS design: steady-state behavior of dynamic gate circuits, noise considerations in dynamic design, charge sharing, cascading dynamic gates, domino logic, np-CMOS logic, problems in single-phase clocking, twophase non-overlapping clocking scheme, Sequential CMOS Logic Circuits, Layout design. 8

Unit IV Semiconductor Memories: Dynamic Random Access Memories (DRAM), Static RAM, non-volatile memories, flash memories, Pipeline Architecture. Low – Power CMOS Logic Circuits: Introduction, Overview of Power Consumption, Low – Power Design through voltage scaling, 8

Unit V Introduction to Testing: Faults in digital circuits. Modeling of faults, Functional Modeling at the Logic Level, Functional Modeling at the Register, Structural Model and Level of Modeling. Design for Testability, Ad Hoc Design for Testability Techniques, Controllability and Observability, Introduction to Built-in-self-test (BIST) Concept. 8

Text Book:

1. Sung-Mo Kang & Yosuf Leblebici, “CMOS Digital Integrated Circuits: Analysis & Design”,Mcgraw Hill, 4th Edition.

2. Neil H.E.Weste, David Money Harris, “CMOS VLSI Design – A circuits and Systems Perspective” Pearson, 4th Edition.

3. D. A. Pucknell and K. Eshraghian, “Basic VLSI Design: Systems and Circuits”, PHI, 3rd Ed.,1994.

Reference Books:

1. R. J. Baker, H. W. Li, and D. E. Boyce , " CMOS circuit design, layout, and simulation", Wiley-IEEE Press,2007.

2. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design" , Jaico Publishing

BT-704

Information Theory & Coding

3L:0T:0P

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Explain each block involved in digital communication thoroughly with applications.

2. Apply the knowledge of basic concepts of probability and entropies to analyze the behavior of a communication system.

3. Analyze the use of source coding and evaluating all the techniques of source coding.

4. Examine the significance of channel coding and evaluating all available techniques of channel coding and decoding with challenges.

5. Examine various error control coding techniques.

3 Credits Unit Topics Lectures

Unit I Entropy

: Entropy, Joint Entropy and Conditional Entropy, Relative Entropy and Mutual Information, Relationship Between Entropy and Mutual Information, Chain Rules for Entropy, Relative Entropy and Mutual Information, Jensen's Inequality and Its Consequences, Log Sum Inequality and Its Applications, DataProcessing Inequality, Fano's Inequality. 8

Unit II Asymptotic Equipartition Property: Asymptotic Equipartition Property Theorem. Consequences of the AEP: Data Compression, High-Probability Sets and the Typical Set Data Compression: Examples of Codes, Kraft Inequality, Optimal Codes, Bounds on the Optimal Code Length, Kraft Inequality for Uniquely Decodable Codes, Huffman Codes, Optimality of Huffman Codes, Shannon– Fano–Elias Coding. 8

Unit III Channel Capacity: Channel Capacity for Various Binary Channels, Symmetric Channels, Properties of Channel Capacity, Preview of Channel Coding Theorem, Jointly Typical Sequences, Channel Coding Theorem, Channel capacity Theorem.

Unit IV Block Codes: Introduction to block codes, Single-parity check codes, Product codes, Repetition codes, Hamming codes, Minimum distance of block codes, Softdecision decoding, Automatic-repeat-request schemes. Linear Block codes: Definition of linear Block Codes, Generator matrices, Standard array, Parity-check matrices, Error detection and correction. 8

Unit V Convolution codes: Encoding convolutional codes, Generator matrices for convolutional codes, Generator polynomials for convolutional codes, Graphical representation of convolutional codes, Viterbi Algorithm, Binary Cycle Codes, BCH codes. RS codes, Golay codes. 8

Text Books:

1. Bose, Information Theory, Coding and Cryptography, McGraw-Hill Education, 3rd Edition, (2016).

2. Joy A. Thomas, Thomas M. Cover, "Elements of information theory", Wiley-Interscience; 2nd edition (July 18, 2006).

3. S. Gravano, "Introduction to Error Control Codes" OUP Oxford (24 May 2001).

4. Robert B. Ash, "Information Theory", Dover Publications (November 1, 1990).

5. Todd k Moon, "Error Correction Coding: Mathematical Methods and Algorithms " Wiley, 2005.

Reference Books:

1. Simon Haykin, "Digital communication", John Wiley.

2. Ranjan Bose, "ITC and Cryptography", Tata McGraw-Hill.

3. Roberto Togneri, Christopher J.S deSilva, “Fundamentals of Information Theory and Coding Design”, CRC Press.

BT-702/BT-806

RENEWABLE ENERGY RESOURCES

3L:0T:0P

Unit I Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations. 8

Unit II Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energystorage for solar heating and cooling, limitations. 8

Unit III Geothermal Energy: Resources of geothermal energy, thermodynamics of geo- thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Cells: Principle of working of various types of fuel cells and their working, performance and limitations. 8

Unit IV Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. Wind Energy: Wind power and its sources, site selection, criterion, momentum

theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems. 8

Unit V Bio-mass: Availability of bio-mass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants. 8

Text Book:

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.

2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.

3. M.V.R. Koteswara Rao, "Energy Resources: Conventional & Non-Conventional" BSP Publications,2006.

4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.

5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.

6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.

BT-701

PROJECT MANAGEMENT & ENTREPRENEURSHIP

3L:0T:0P 3

Unit I Entrepreneurship: Entrepreneurship: need, scope , Entrepreneurial competencies & traits, Factors affecting entrepreneurial development, Entrepreneurial motivation (Mc Clellend's Achievement motivation theory), conceptual model of entrepreneurship , entrepreneur vs. intrapreneur; Classification of entrepreneurs; Entrepreneurial Development Programmes 8

Unit II Entrepreneurial Idea and Innovation: Introduction to Innovation, Entrepreneurial Idea Generation and Identifying Business Opportunities, Management skills for Entrepreneurs and managing for Value Creation, Creating and Sustaining Enterprising Model & Organizational Effectiveness 8

Unit III Project Management: Project management: meaning, scope & importance, role of project manager; project life-cycle Project appraisal: Preparation of a real time project feasibility report containing Technical appraisal,; Environmental appraisal, Market appraisal (including market survey for forecasting future demand and sales) and Managerial appraisal. 8

Unit IV Project Financing: Project cost estimation & working capital requirements, sources of funds, capital budgeting, Risk & uncertainty in project evaluation , preparation of projected financial statements viz. Projected balance sheet, projected income statement, projected funds & cash flow statements, Preparation of detailed project report, Project finance. 8

Unit V Social Entrepreneurship: Social Sector Perspectives and Social Entrepreneurship, Social Entrepreneurship Opportunities and Successful Models, Social Innovations and Sustainability, Marketing Management for Social Ventures, Risk Management in Social Enterprises, Legal Framework for Social Ventures. 8

Text Book:

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row

2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas

3. Entrepreneurship: Roy Rajeev; OUP.

4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan

5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI

6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.;

BT-803

ELECTRONIC SWITCHING

3 1 0

COURSE OUTCOMES:

Student will be able to:

1 Describe and apply fundamentals of telecommunication systems and associated technologies.

2 Solve problems and design simple systems related to tele-traffic and trunking efficiency.

3 Understand and explain the reasons for switching, and the relative merits of the possible switching modes, e.g. packet and circuit switching.

4 Understand the principles of the internal design and operation of telecommunication switches, and the essence of the key signalling systems that are used in telecommunication networks.

Units

I Evolution of switching systems: Introduction, Message switching, Circuits switching, Functions of a switching system, Register-transistor-senders, Distribution frames, Crossbar switch, A general trucking, Electronic switching, Reed- electronic system, Digital switching systems.

8

Units II

Digital Switching: Switching functions, Space Division Switching, Time Division Switching, Two-Dimensional Switching, Digital Cross-Connect Systems , Digital Switching in an Analog Environment

8

Units III

Telecom Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking models and Loss Estimates, Delay Systems

8

Units IV Control of switching systems: Introduction, Call-processing functions, Common control, Reliability, availability and security; Stored-program control. Signalling: Introduction, Customer line signalling, Audio-frequency junctions and trunk circuits, FDM carrier systems,

PCM signalling, Inter-register signalling, Common-channel signalling principles, CCITT signalling system no. 6 and 7, Digital customer line signalling.

8

Units V Packet Switching: Packet Switching, Statistical Multiplexing, Routing Control (dynamic routing, virtual circuit routing and fixed-path routing), Flow Control, X.25, Frame Relay, TCP/IP ATM Cells, ATM Service Categories, ATM Switching (ATM Memory Switch, Space-Memory Switch, Memory-Space Switch, Memory-Space-Memory switch, Banyan Network Switch).

8

Text Books:

1. Thiagarajan Viswanathan & Manav Bhatnagar, "Telecommunication Switching Systems andNetworks", PHI.

2. J.E. Flood, "Telecommunication Switching, Traffic and Networks", Pearson Education.

3. John C. Bellamy, "Digital Telephony", John Wiley, 3rd Ed.

BT-802

Wireless & Mobile Communication

3 0 0

COURSE OUTCOME:

After completion of the course student will be able to

1 Familiarize with various generations of mobile communications.

2 Understand the concept of cellular communication.

3 Understand the basics of wireless communication.

4 Understand GSM mobile communication standard, its architecture, logical channels, advantages and limitations.

5 Gain knowledge of IS-95 CDMA mobile communication standard, its architecture, logical channels, advantages and limitations.

6 Gain knowledge of 3G mobile standards and their comparison with 2G technologies.

Unit I

Evolution of mobile radio communication fundamentals. General Model of Wireless Communication Link, Types of Signals, Cellular Infrastructure, Cellular System Components, Antennas for Cellular Systems, Operation of Cellular Systems, Channel Assignment, Frequency reuse, Channel Assignment strategies, Handoff Strategies Cellular Interferences, Sectorization; Wireless Channel and Radio Communication, Free Space Propagation Model, Channel Noise and Losses, Fading in Land Mobile Systems, Multipath Fading, Fading Effects on Signal and Frequency, Shadowing.

8

Units II

Wireless Channel Modeling: AWGN Channel, Rayleigh Channel, Rician Fading Channel, Nakagami Fading Channel, Ocumura and Hata Path Loss Model; Channel Modelling: Stochastic, Flat Fading, Wideband TimeDispersive Channel Modelling.

8

Units III

Theory of Vocoders, Types of Vocoders; Spread Spectrum Modulation, Pseudo-Noise Codes with Properties and Code Generation Mechanisms, DSSS and FHSS Systems, Time Hopping and Hybrid Spread Systems; Multicarrier Modulation Techniques. Zero Inter Symbol Interference Communication Techniques, Detection Strategies, Diversity Combining Techniques: Selection Combining, Threshold Combining, Equal Gain Combining, Maximum Ratio

Combining; Spatial Diversity and Multiplexing in MIMO Systems, Channel Estimation. Equalization Techniques: Transversal Filters, Adaptive Equalizers, Zero Forcing Equalizers, Decision Feedback Equalizers, and related algorithms. 8

Units IV

Multiplexing and Multiple Access: FDMA, TDMA, CDMA, OFDMA, SCFDMA, IDMA Schemes and Hybrid Method of Multiple Access Schemes, RAKE Receiver; Multiple Access for Radio Packet Systems: Pure ALOHA, Slotted ALOHA, CSMA and their versions; Packet and Pooling Reservation Based Multiple Access Schemes.

8

Units V

GSM system for mobile Telecommunication, General Packet Radio Service, Edge Technology; CDMA 2000, Wireless Local Loop, IMT 2000 and UMTS, Long Term Evolution (LTE), Mobile Satellite Communication, Introduction to Mobile Adhoc Networks, Li-Fi Communication, Ultra-Wideband Communication, Mobile data networks, Wireless Standards IMT 2000, Introduction to 4G and concept of NGN.

8

Text Book:

1. T.S. Rappaport, "Wireless Communication-Principles and practice", Pearson

Publications,Second Edition.

2. Misra, Wireless Communication & Network: 3G & Beyond, McGraw Hill Education

3. Jaganathan, Principles of Modern Wireless Communication System, McGraw Hill Education

4. Upena Dalal, "Wireless Communication and Networks", Oxford Press Publications.

5. T L Singal ,"Wireless Communications ", McGraw Hill Education.

Reference Books:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press.

2. S. Haykin & M. Moher, "Modern wireless communication", Pearson, 2005.