ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS
(Choice Based Credit System)

R19

Electronics and communication Engineering

For

B.TECH. FOUR YEAR DEGREE COURSE

(Applicable for batches admitted from 2019-2020)

SWARNANDHRA
COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

SEETHARAMAPURAM, NARSAPUR-534 280, W.G.DT., A.P.

ACADEMIC REGULATIONS

1. INTRODUCTION

Swarnandhra College of Engineering & Technology (**Subsequently referred to as SCET**) will be followed the norms of Jawaharlal Nehru Technological University Kakinada and Govt. of Andhra Pradesh.

All Academic Programme rules and regulations are approved by the Academic Council, which is the highest Academic body of the Institute. It is applicable for all Bachelor of Technology (B. Tech) degree programme from academic year 2019-20 admission onwards.

2. ADMISSIONS

2.1 Regular Admission

(Join in first year B. Tech Programme)

Admissions in the Institution are classified into **CATEGORY – A,** through convener, EAMCET and **CATEGORY- B** filled by the college management.

2.2 Lateral Entry Admission

(Join in the Second year/third semester of B. Tech Programme)

Eligibility: B.Sc. Graduate & Diploma holders.

Based on the rank secured by the candidate at Engineering Common Entrance Test (ECET) conducted by the convener ,ECET, and Central counseling by Higher Education, Government of Andhra Pradesh.

2.3 Advance standing Admission

(Transfer from other Colleges/ Re-admission due to dis-continuation)

These may arise in the following cases:

a) When a student seeks transfer from other colleges to SCET and desirous to pursue the study at SCET in an eligible branch of study.
b) When students of SCET get transferred from one regulation to another regulation or from previous syllabus to revised syllabus.

In all such cases for admission, when needed, permissions from the statutory bodies are to be obtained and the Programme of study at SCET will be governed by the transitory regulations.

3. UNDER GRADUATE PROGRAMMES OFFERED

Presently, the College is offering Under Graduate Programmes in the following disciplines:

- Computer Science and Engineering (CSE)
- Electronics and communication Engineering (ECE)
- Electrical and Electronics Engineering (EEE)
- Information Technology (IT)
- Mechanical Engineering (ME)
- Civil Engineering (CE)

3.1 Structure of the Programme:

i) **Preamble:**

It is emphasized in UGC Guidelines on Choice Based Credit System (CBCS), that the important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters. It is adopted grading system in place of conventional system of marks and percentages.

Our CBCS provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The students can register any courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach through open electives.

Key words CBCS, such as Course, credit, credit point, CGPA, SGPA, Grade Point, Letter Grades, Foundation Courses (FC), Programme Core Course (PCC) and Elective Courses (EC) as given in the UGC guidelines are used the same definitions.

Each Programme of a Discipline or branch will consist of:

i). Foundation courses in Basic Sciences, Engineering Sciences and Humanities.
ii). Programme core courses to impart broad based knowledge needed in the concerned branch.
iii). Elective courses from the discipline or interdisciplinary areas / industry related opted by the student based on their interest in specialization.
iv). Open Elective courses from the interdisciplinary areas opted by the students based on their interest in specialization.

Each Programme designed to have 35-40 theory courses and 20-25 laboratory courses. The categories of courses are indicated in the following table.

TABLE-1 CATEGORY OF COURSES

Course Category
Foundation Courses – Basic Sciences & Humanities
Foundation Courses – Engineering Sciences
Programme Core Courses in the branch of study
Elective Courses
Open Elective

Note: All components prescribed in the curriculum will be conducted and evaluated.

ii) **Contact hours:** Depending on the complexity and volume of the course the number of contact hours per week will be determined.

iii) **Credits:**

TABLE-2 CREDITS BASED ON CONTACT HOURS

Course type	No. of Contact Hours	No. of Credits
Theory	1	1
Laboratory	2	1

TABLE-3 CREDITS FOR DIFFERENT COURSES

Course type	Lecture method			Credits
	L	T	P	C
Theory /Elective	3	1	0	4
	2	1	0	3
	3	0	0	3
	2	0	2	3
	2	0	0	2
Laboratory	0	0	2	1
	0	0	3	1.5
	0	0	4	2

3.2 Curriculum for each Programme:

- The Four year curriculum of any B. Tech Programme of study in any branch of Engineering is formulated based on the guidelines mentioned in 3.1 and will be recommended by the concerned Board of Studies and is approved by the Academic Council.
- In case of students admitted under lateral entry, the respective regular curriculum contents from 3rd semester onwards are to be pursued by them.
- In case of students admitted under advanced standing, the equivalence will be prepared by the concerned Board of Studies and the Academic Council has to approve the same..

4. DURATION OF THE PROGRAMME:

The duration of the B. Tech. Programme is four academic years consisting of eight semesters. Students, who fail to fulfill all the academic requirements for the award of the degree within the prescribed duration as per article 4.1, will forfeit their admission in B. Tech course**.**

4.1 Maximum duration of study.

Maximum duration permitted for any student to successfully complete the four year B. Tech. Programme of study will be:

Regular Admission: Eight academic years in sequence from the year of admission for a student admitted into first year of any Programme.
Lateral Entry Admission: Six academic years in sequence from the year of admission for a student admitted into second year of any Programme.
Advanced standing Admission: The maximum time for completion of Programme of study, will be twice the period in terms of academic years in sequence, stipulated in the Programme curriculum defined at the time of admission.

4.2 Cancellation of Admission :

In case, any student fails to meet the above applicable/eligible conditions for the award of degree, his/her admission stands cancelled.

TABLE- 4 MAXIMUM DURATION OF STUDY

Admitted year of study	Maximum duration
First year	8 academic years in sequence
Second year (Lateral entry)	6 academic years in sequence
Advanced standing	Twice the period in terms of academic years in sequence

5. MEDIUM OF INSTRUCTION :
The medium of instruction and examinations are in English.

6. MINIMUM INSTRUCTION DAYS: Each semester will consist of 22 weeks duration with minimum of 110 working days which includes instruction days, internal tests and End examinations.

7. TRANSITORY REGULATIONS:

For those who admitted under advance standing, these transitory regulations will provide the modus of operandi. At the time of such admission, based on the Programme pursued (case by case)

- Equivalent courses completed by the student are established by the BOS of concerned discipline.
- Marks/Credits are transferred for all such equivalent courses and treated as successfully completed in the Programme of study prescribed by SCET.
- A Programme chart of residual courses not completed will be derived and a Programme of study with duration specified will be prescribed for pursuit at SCET.
- Marks obtained in the previous system, as the case maybe, shall be converted to equivalent grades and CGPA.

All other modalities and regulations governing shall be the same as those applicable to the stream of students with whom; such a candidate is merged with current regulations.

8. DISTRIBUTION AND WEIGHTAGE OF MARKS:

Each semester consists of 4/5/6 theory courses and 2/3/4 Laboratories. However, in the 8th semester there will be only 2 theory courses in addition to the project work.

(a). **Theory Courses:**

- Each course consists of five units.
- All courses will be evaluated with a maximum of 100 marks.
- Marks distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination.
- The internal evaluation of 30 marks consists of two cycles. Each cycle consists of descriptive test (internal test) for 20 marks and two class tests for 10 marks.
- Mid Examination: Each mid examination will be conducted for 20 marks with the duration of 75 Minutes. Internal test paper consists of three questions (8M+8M+4M) from two and half units and all are to be answered.
- Class tests for 10 marks calculation: There will be two class tests conducted in each cycle unit wise. **Best of two** will be considered.
- **Weighted average of two Cycles** performance will be considered, weightage of 80% for the best Cycle performance and 20% for second.
- The **end semester** examination will be conducted for 70 marks which covers full syllabus. In end examination pattern, **Part – A** consists of five short questions from all units (Brainstorming/Thought provoking/Case study) for 10 marks. **Part – B** has **5 questions** with internal choice from each unit and valued for 60 marks.

(b). **Practical Courses:**

- All courses will be evaluated with a maximum of 100 marks.
- Marks distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination.
- End practical examination will be conducted by the internal and external examiner appointed by COE.
- Internal evaluation will be a continuous assessment during the semester for 30 marks with 15 marks for day-to-day work, including record valuation and 15 marks for internal test.

(c). **Design or Engineering Drawing Marks Distribution:**

For the courses of design or drawing such as Engineering Graphics, etc., the distribution will be 30 marks for internal evaluation with 10 marks for day-to-day work, and 20 marks from two internal tests (80% of first best + 20% of second best). End examination will be conducted for 70 marks.

(d) **Internship:** It can be carried out with a minimum of two weeks and maximum of four weeks, any time after completion of 4^{th} semester till end of 7^{th} semester. It will be evaluated internally by an internal evaluation committee comprising of Head of the Department and two faculty of the department. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits

(e) **Mini Project:** The $6^{th}/7^{th}$ Semester Mini Project work will be evaluated for 100 marks.

The project work is evaluated for internal assessment for 30 and external examination for 70.

i) Internal Assessment: Internal Assessment will be monitored by Project Review Committee consisting of 1) Head of the Department 2) Supervisor and 3) Senior faculty member on the basis of two seminars and the internal marks will be awarded by Project Supervisor with recommendation of PRC.

ii) External Examination: External Examination will be conducted through presentation / viva - voice by the student by Project external examination committee consisting of 1) Head of the Department 2) Supervisor and 3) External examiner appointed by COE.

(g) Project Work: The 8th Semester main Project Work will be evaluated for 200 marks. The project work is evaluated for internal assessment of 60 and external examination for 140.

i) Internal Assessment: Internal Assessment will be monitored by Project Review Committee consisting of 1) Head of the Department 2) Supervisor and 3) Senior faculty member on the basis of two seminars and the internal marks will be awarded by Project Supervisor with recommendation of PRC.

ii) External Examination: External Examination will be conducted through presentation / viva - voice by the student by Project external examination committee consisting of 1) Head of the Department 2) Supervisor and 3) External examiner appointed by COE.

TABLE- 5 MARKS ALLOCATION

Course type	Marks Allocation			
	Internal		End Semester	Total
	Internal test	Class Test/ Day to day work		
Theory course	20	10	70	100
Laboratory course	15	15	70	100
Design or Drawing course	20	10	70	100

(h) Mandatory Courses: These courses are compulsory with zero credits. They shall be no external examination. However attendance in the mandatory course of minimum attendance (75%) in that particular course.

(i) Open Electives: Students are to choose Open Elective – I during 5th Semester, Open Elective–II during 6th Semester and Open Elective – III and IV during 7th Semester from the list of Open Electives given in the Course Structure. However, students cannot opt for an Open Elective Subject offered by their own (parent) Department, if it is already listed under any category of the courses offered by the parent Department in any Semester.

9. ATTENDANCE REGULATIONS

(i) A student will be eligible to appear for end semester examinations, if he/she acquired a minimum of 75% of attendance in aggregate of all the courses.

(ii) Condonation of shortage of attendance in aggregate up to 10% on medical grounds (Above 65% and below 75%) in any semester may be granted by the College Academic Committee.

(iii) Shortage of Attendance below 65% in aggregate shall not be condoned.

(iv) Students with less than 65% of attendance in any semester are not eligible to take up their end examination of that particular semester and their registration for examination shall be allowed.

(v) Attendance may also be condoned for those who participate in Intercollegiate/university sports, co- and extracurricular activities provided their attendance is in the minimum prescribed range for the purpose (>65%) and recommended by the concerned authority. He/ She shall pay the prescribed condonation fee.

(vi) Prescribed Condonation fee shall be payable by the student to appear for the end examination.

(vii) A Student will not be promoted to the next semester unless he/she satisfies the attendance requirement of the present semester as applicable. They may seek re-admission for that semester as and when offered consecutively by the Department.

(viii) A student will be condoned only four times for regular student and three times for lateral entry students during entire course of study.

TABLE-7 ATTENDANCE REQUIREMENT

Attendance Percentage	Condonation fee	Appear End Exams
Above 75 %	Nil	Eligible
65 % -75%	Yes (on medical grounds)	Eligible
Below 65 %	Nil	Not Eligible (Seek re-admission to that semester when offered)

10. MINIMUM ACADEMIC REQUIREMENTS:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in **S.No.9.**

(i) A student will be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical or design or drawing subject or project if he/she secures not less than a minimum of 35% of marks exclusively in the end semester examinations in each of the courses, for which the candidate had appeared. However, the candidate should have secured a minimum of 40% marks in both external and internal components put together to declare eligible for pass in the subject.

(ii) A student will be promoted from first semester to second semester, second semester to third and third to fourth semester, if he/she satisfies the minimum attendance requirement.

(iii) A student will be promoted from 4^{th} Semester to 5^{th} Semester, if he/she fulfills the academic requirements of 40% of the credits up to 4^{th} Semester from all the examinations (Regular and supplementary) whether or not the candidate takes the examinations.

(iv) A student will be promoted from 6^{th} to 7^{th} Semester, only if he/she fulfills the academic requirements of 40% of the credits up to 6^{th} Semester from, all the examinations (regular and supply) whether or not the candidate takes the examinations.

(v) There will be supplementary examinations along with the regular semester examinations enabling the students to give a fair chance to appear in the subject if any failed.

TABLE-8 PROMOTION IN TO NEXT HIGHER CLASS

Promotion From	Promotion to	Promotion Criteria
1^{ST} Semester	2^{nd} Semester	Minimum Attendance requirement
2^{nd} Semester	3^{rd} Semester	
3^{rd} Semester	4^{th} Semester	
4^{th} Semester	5^{th} Semester	Minimum Attendance requirement & 40% of credits up to 4^{th} semester for all exams
5^{th} Semester	6^{th} Semester	Minimum Attendance requirement
6^{th} Semester	7^{th} Semester	Minimum Attendance requirement & 40% of credits up to 6^{th} semester for all exams
7^{th} Semester	8^{th} Semester	Minimum Attendance requirement

11. GAP YEAR CONCEPT

Students who wish to pursue entrepreneurship full time can take break of one year study, after the 4th Semester with the due recommendations of the GAP committee and approved by the principal. This may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation

12. ELIGIBILITY FOR AWARD OF DEGREE:

A student shall be eligible for award of the B.Tech. Degree if he/she fulfills all the following conditions:

(i) Pursue the programme of study for a stipulated period of four years and not more than eight years.

(ii) Register for 160 credits and secure the same.

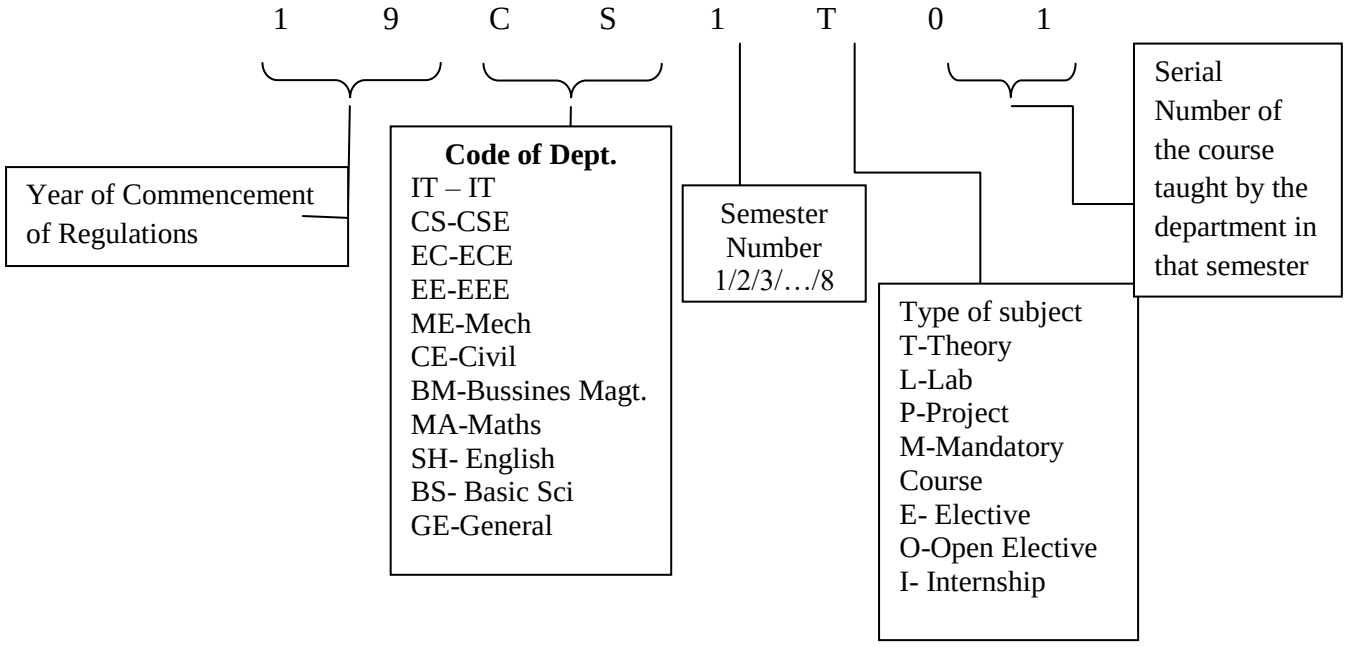
(iii) Registered and successfully completed all the components prescribed in the programme of study in which he/she is admitted.

(iv) All mandatory courses must be completed with satisfactory.

(v) Obtained CGPA greater than or equal to 4.75 (minimum requirements for pass).

13. COURSE CODE & COURSE NUMBERING SCHEME:

The subject codes will be given by the department teaching the subject. Each subject code contains 8 characters. The 8 characters for each subject will be filled as per the following guidelines.



14. GRADING SYSTEM:

14.1 Award of Grade:

(i) Grade Point Average (GPA):

a) The Grade Point Average (GPA) will be calculated according to the formula

$$GPA = \frac{\sum C_i G_i}{\sum C_i}$$

Where C_i = number of credits for the subject i

G_i = grade points obtained by the student in the subject.

b) To arrive at Cumulative Grade Point Average (CGPA), the formula is used considering the student's performance in all the courses taken in all the semesters completed up to the particular point of time.

$$CGPA = \frac{\sum C_i G_i}{\sum C_i}$$

Where C_i = number of credits for the subject i

G_i = grade points obtained by the student in the subject.

c) Equivalent percentage = (CGPA-0.75) x 10

(ii) After a student satisfy the requirements prescribed for the award of UG/PG Programme he/she shall be placed in one of the following four grades. The award of the degree is based on CGPA on a grade point scale of 10 and given in Table 9.

Table -9

CGPA	Award of Division
≥7.75*	First Class with Distinction
≥6.75	First Division
≥5.75	Second Division
≥4.75	Pass Division
<4.75	Unsatisfactory

* In addition to the required CGPA of 7.75, the student must have necessarily passed all the courses of every semester in the minimum stipulated period for the programme.

14.2 Award of Grade in Each Semester:

(i) Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester for each subject. The letter grades and the corresponding grade points are as given in the Table 10.

Table -10

Percentage of Marks Scored	Letter Grade	Level	Grade points
>=90	O	Outstanding	10
80 - 89	S	Excellent	9
70-79	A	Very Good	8
60-69	B	Good	7
50-59	C	Fair	6
40-49	D	Satisfactory	5
<40	F	Fail	0
		Absent	0

(ii) A student earns a minimum of 5 grade points (D grade) in a subject is declared to have successfully completed the subject, and is deemed to have earned the credits assigned to that subject. However, it should be noted that a pass in any subject/term paper/seminar/project/mini project shall be governed by the rules mentioned in **S.No. 8**.

(iii) Grade Sheet: A grade sheet (memorandum) will be issued to each student indicating his/her performance in all courses taken in that semester and also indicating the grades.

(iv) Transcripts: After successful completion of the programme of study, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued up to any point of study to the student on request and by paying stipulated fee in force.

(v) Candidates shall be permitted to apply for revaluation within the stipulated period with payment of prescribed fee.

(vi) The Academic Council has to approve and recommend to the JNTUK, Kakinada for the award of a degree to any student.

14. SUPPLEMENTARY EXAMINATIONS:

In addition to the Regular Final Examinations held at the end of each semester, a Supplementary Examination will be conducted. A student can appear for any number courses of supplementary examinations till he/she clears the courses. However the maximum stipulated period of programme cannot be relaxed under any circumstance.

15. ADVANCED SUPPLEMENTARY EXAMINATIONS:

Candidate who fails the courses in 7th and 8th Semester can appear for Advanced Supplementary Examinations.

16. ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME):

i. The students have to acquire 120 credits from 3rd Semester to 8th Semester of B. Tech Programmefor the award of the degree.
ii. All mandatory courses must be completed with satisfactory for award of degree.
iii. Obtained CGPA greater than or equal to 4.75 (minimum requirements for pass).
iv. The same attendance regulations are to be adopted as per the rules mentioned in item No.10.
v. **Rules for Promotion from 6th Semester to 7th Semester**: A student shall be promoted from 6th Semester to 7th Semester only if he/she fulfills the academic requirements of 40% credits up to 6th Semester.
vi. Students, who fail to fulfill the requirement for the award of the degree in six consecutive academic years from the year of admission, shall forfeit their seat.

17. CONDUCT AND DISCIPLINE:

Students admitted in SCET are to be followed the conduct and discipline of the college and which will be updated from time to time.

18. MALPRACTICES:

If any malpractices held in internal assessment tests or Semester-End Examinations, Principal constitute a Malpractice Enquiry Committee to enquire the case. The principal shall take necessary action based on the recommendations of the committee as per stipulated norms.

19. WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the institution or if any case of indiscipline is pending against him, the result of the student will be withheld. His degree will be withheld in such cases.

20. ACADEMIC FLEXIBILITY:

Students can study two elective courses of 8th Semester in advance, one in 6th and the other in 7th semester, those who cleared all the courses with CGPA 8.50 up to 5th semester. If a student fails in any course of the 6th/ 7thsemester, the flexibility will be cancelled. 8th Semester elective courses can study in advance from the MOOC/NPTEL/SWAYAM/etc.,courses.

21. GENERAL:

a) Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
b) The academic regulation should be read as a whole for the purpose of any interpretation.
c) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final and which is to be ratified by the Chairman of the Governing Body.
d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

SEMESTER-I

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19MA1T01	Calculus and Linear Algebra	3	1	-	4.0	30	70	100
2	19BS1T01	Engineering Physics	3	-	-	3.0	30	70	100
3	19CS1T01	Problem Solving and Programming Using C	3	-	-	3.0	30	70	100
4	19ME1T01	Engineering Graphics	3	-	-	3.0	30	70	100
5	19CS1L02	IT Workshop	-	-	3	1.5	30	70	100
6	19BS1L01	Engineering Physics Lab	-	-	3	1.5	30	70	100
7	19CS1L01	C Programming Lab	-	-	3	1.5	30	70	100
8	19HS1L01	English Proficiency Lab	-	-	3	1.5	30	70	100
		Total	**12**	**01**	**12**	**19.0**	**240**	**560**	**800**

SEMESTER-II

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19MA2T03	Vector Calculus and Numerical Methods	3	-	-	3.0	30	70	100
2	19BS2T02	Engineering Chemistry	3	-	-	3.0	30	70	100
3	19CS2T02	Object Oriented Programming Using C++	3	-	-	3.0	30	70	100
4	19EE2T02	Electrical Networks	3	-	-	3.0	30	70	100
5	19HS2T01	English	3	-	-	3.0	30	70	100
6	19ME2L01	Engineering Workshop	-	-	3	1.5	30	70	100
7	19BS2L02	Engineering Chemistry Lab	-	-	3	1.5	30	70	100
8	19CS2L03	C++ Programming Lab	-	-	3	1.5	30	70	100
9	19HS2L02	English Communication Skills Lab	-	-	3	1.5	30	70	100
		Total	**15**	**-**	**12**	**21.0**	**270**	**630**	**900**

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS.
IM-INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

SEMESTER-III

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19MA3T07	Complex Variables and Random Process	3	-	-	3.0	30	70	100
2	19EC3T01	Electronic Circuits-I	3	-	-	3.0	30	70	100
3	19EC3T02	Digital Electronics	3	-	-	3.0	30	70	100
4	19EC3T03	Signals and Systems	3	1	-	4.0	30	70	100
5	19CS3T02	Data Structures	3	-	-	3.0	30	70	100
6	19EC3L01	Electronic Circuits-I Lab	-	-	3	1.5	30	70	100
7	19EC3L02	Digital Electronics Lab	-	-	3	1.5	30	70	100
8	19CS3L01	Data Structures Lab	-	-	4	2.0	30	70	100
9	19CE0M01	Environmental Science	2	-	-	-	-	-	-
		Total	**17**	**1**	**10**	**21.0**	**240**	**560**	**800**

SEMESTER-IV

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19EC4T01	Electronic Circuits - II	3	-	-	3.0	30	70	100
2	19EC4T02	Analog And Digital Communication	3	-	-	3.0	30	70	100
3	19EC4T03	Electromagnetic Waves and Transmission Lines	3	-	-	3.0	30	70	100
4	19EE4T02	Control Systems	3	1	-	4.0	30	70	100
5	19EE4T04	Electrical Engineering	3	-	-	3.0	30	70	100
6	19EC4L01	Electronics Circuits-II Lab	-	-	3	1.5	30	70	100
7	19EC4L02	Analog and Digital Communication Lab	-	-	3	1.5	30	70	100
8	19CS4L03	Python Programming and Application Lab	-	-	4	2.0	30	70	100
9	19BM0M01	Professional Ethics and Intellectual Property Rights	2	-	-	-	-	-	-
		Total	**17**	**1**	**10**	**21.0**	**240**	**560**	**800**

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS.
IM-INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

SEMESTER – V

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19EC5T01	Linear and Digital IC Applications	3	-	-	3.0	30	70	100
2	19EC5T02	Microprocessor and Microcontroller	3	1	-	3.0	30	70	100
3		**Elective-I**	3	-	-	3.0	30	70	100
4		**Open Elective-I**	3	-	-	3.0	30	70	100
5	19EC5T03	Antennas and Wave Propagation	3	-	-	3.0	30	70	100
6	19EC5L01	Linear and Digital IC Applications Lab	-	-	3	1.5	30	70	100
7	19EC5L02	Microprocessor and Microcontroller Lab	-	-	3	1.5	30	70	100
8	19CS5L04	Java Programming Lab	-	-	4	2.0	30	70	100
9	19BM0M02	Introduction to Cyber Law	2	-	-	-	-	-	-
		Total	**17**	**1**	**10**	**20.0**	**240**	**560**	**800**

SEMESTER – VI

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19EC6T01	Digital Signal Processing	3	1	-	4.0	30	70	100
2	19EC6T02	VLSI Design	3	-	-	3.0	30	70	100
3	19BM6T01	Managerial Economics and Financial Analysis	3	-	-	3.0	30	70	100
4		**Elective-II**	3	-	-	3.0	30	70	100
5		**Open Elective-II**	3	-	-	3.0	30	70	100
6	19EC6L02	VLSI Design Lab	-	-	3	1.5	30	70	100
7	19EC6L01	Digital Signal Processing Lab	-	-	3	1.5	30	70	100
8	19HS6L03	Advanced English Communication Skills Lab	-	-	2	1.0	30	70	100
9	19BM0M03	Indian Constitution	2	-	-	-	-	-	-
		Total	**17**	**1**	**8**	**20.0**	**240**	**560**	**800**

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS.
IM-INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

SEMESTER – VII

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19EC7T01	Microwave and Optical Communication	3	-	-	3.0	30	70	100
2	19EC7T02	Embedded System	3	-	-	4.0	30	70	100
3		**Elective – III**	3	-	-	3.0	30	70	100
4		**Open Elective-III**	3	-	-	3.0	30	70	100
5		**Open Elective-IV**	3	-	-	3.0	30	70	100
6	19EC7L01	Microwave and Optical Communication Lab	-	-	3	1.5	30	70	100
7	19EC7L02	Embedded System Lab	-	-	3	1.5	30	70	100
8	19EC7P01	Mini Project	-	-	6	3.0	30	70	100
9	19EC7I01	Internship	-	-	2	1.0	50	-	50
		Total	**15**	**-**	**14**	**23.0**	**290**	**560**	**850**

SEMESTER – VIII

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1		**Elective – IV**	3	-	-	3.0	30	70	100
2		**Elective –V**	3	-	-	3.0	30	70	100
3	19EC8P01	Project Work	-	-	18	9.0	60	140	200
		Total	**6**	**-**	**18**	**15.0**	**120**	**280**	**400**

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS.
IM-INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

ELECTIVES

ELECTIVE I

S.No	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19EC5E01	Nano Technology	3	0	0	3	30	70	100
2	19EC5E02	Information Theory Coding	3	0	0	3	30	70	100
3	19CS5E18	Computer System Architecture	3	0	0	3	30	70	100
4	19EC5E03	Transform Techniques	3	0	0	3	30	70	100
5	19CS5E19	Operating Systems Concepts	3	0	0	3	30	70	100

ELECTIVE II

S.No	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19EC6E04	Digital System Design	3	0	0	3	30	70	100
2	19EC6E05	Radar and Satellite System	3	0	0	3	30	70	100
3	19CS6E20	Computer Networking Concepts	3	0	0	3	30	70	100
4	19EC6E06	Digital Image Processing	3	0	0	3	30	70	100
5	19CS6E21	Database Management Systems	3	0	0	3	30	70	100

ELECTIVE III

S.No	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19EC7E07	Analog IC Design	3	0	0	3	30	70	100
2	19EC7E08	Cellular and Mobile Communication	3	0	0	3	30	70	100
3	19EC7E09	Sensors and Instrumentation	3	0	0	3	30	70	100
4	19EC7E10	Speech Processing	3	0	0	3	30	70	100
5	19CS7E24	Real Time Operating System	3	0	0	3	30	70	100

ELECTIVE IV

S.No	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19EC8E11	Design for Testability	3	0	0	3	30	70	100
2	19EC8E12	Global Positioning and Navigation Satellite Systems	3	0	0	3	30	70	100
3	19CS8E27	Internet of Things and Applications	3	0	0	3	30	70	100
4	19EC8E13	Video Processing	3	0	0	3	30	70	100
5	19CS8E28	Artificial Intelligence	3	0	0	3	30	70	100

ELECTIVE V

S.No	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	19EC8E14	Digital Design Using HDL	3	0	0	3	30	70	100
2	19EC8E15	Wireless Communication	3	0	0	3	30	70	100
3	19EC8E16	Television Systems and Design	3	0	0	3	30	70	100
4	19EC8E17	Pattern Recognition	3	0	0	3	30	70	100
5	19CS8E25	Machine Learning	3	0	0	3	30	70	100

LIST OF OPEN ELECTIVES

S. No.	COURSE CODE	COURSE TITLE	L	T	P	C	IM	EM	TM
1	19EEXO01	Electrical Safety Management	3	-	-	3	30	70	100
2	19EEXO02	Non-conventional Energy sources	3	-	-	3	30	70	100
3	19EEXO03	Electrical Vehicle	3	-	-	3	30	70	100
4	19EEXO04	Electrical Energy Conservation and Auditing	3	-	-	3	30	70	100
5	19CEXO01	Disaster Management	3	-	-	3	30	70	100
6	19CEXO02	Environmental Pollution and Control	3	-	-	3	30	70	100
7	19CEXO03	Solid Waste Management	3	-	-	3	30	70	100
8	19CEXO04	Building Planning and Drawing	3	-	-	3	30	70	100
9	19MEXO01	3D Printing	3	-	-	3	30	70	100
10	19MEXO02	Farm Machinery	3	-	-	3	30	70	100
11	19MEXO03	Bio-Mechanical Engineering	3	-	-	3	30	70	100
12	19MEXO04	Waste to Energy Conversion	3	-	-	3	30	70	100
13	19CSXO01	Internet of Things and Applications	3	-	-	3	30	70	100
14	19CSXO02	Foundation to Data Analytics	3	-	-	3	30	70	100
15	19CSXO03	Data Engineering	3	-	-	3	30	70	100
16	19CSXO04	Machine Learning	3	-	-	3	30	70	100
17	19ECXO01	Nanotechnology and Applications	3	-	-	3	30	70	100
18	19ECXO02	Global Positioning and Navigation Satellite Systems	3	-	-	3	30	70	100
19	19ECXO03	Remote Sensing	3	-	-	3	30	70	100
20	19ECXO04	Mobile Communication and Applications	3	-	-	3	30	70	100
21	19ITXO01	Software Engineering Principles	3	-	-	3	30	70	100
22	19ITXO02	Cloud Computing Principles	3	-	-	3	30	70	100
23	19ITXO03	E-Commerce	3	-	-	3	30	70	100
24	19ITXO04	Web Technology Principles	3	-	-	3	30	70	100
25	19BMXO01	Innovations and Entrepreneurship	3	-	-	3	30	70	100
26	19BMXO02	Industrial Sociology and Psychology	3	-	-	3	30	70	100
27	19BMXO03	Digital Marketing	3	-	-	3	30	70	100
28	19BMXO04	Business Environment	3	-	-	3	30	70	100
29	19MAXO01	Operations Research	3	-	-	3	30	70	100
30	19MAXO02	Optimization Models	3	-	-	3	30	70	100
31	19BSXO01	Quantum Computing	3	-	-	3	30	70	100
32	19BSXO02	Optoelectronics	3	-	-	3	30	70	100

I SEMESTER	L	T	P	C
	3	1	-	4
19MA1T01 - CALCULUS AND LINEAR ALGEBRA				

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various realworld problems and their applications.

Bridge Course: Limits, continuity, Types of matrices

Unit I: Matrix Operations and Solving Systems of Linear Equations

Rank of a matrix by echelon form, Normal form - solving system of homogeneous and non- homogeneous linear equations- Gauss Elimination, Jacobi and Gauss Seidel methods - Eigen values and Eigen vectors and their properties (without proof).

Learning Outcomes:

At the end of this unit, the student will be able to
solve systems of linear equations, determine the rank, Eigen values and eigenvectors(K2).

Unit II: Cayley-Hamilton theorem and Quadratic forms

Cayley-Hamilton theorem (without proof), Finding inverse and power of a matrix by Cayley-Hamilton theorem - Reduction to diagonal form - Quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical form by orthogonal transformation.

Learning Outcomes:

At the end of this unit, the student will be able to

- reduce to diagonal form and identify special properties of a matrix, such as positive definite, etc.,and use this information to facilitate the calculation of matrix characteristics; (K3)

Unit III: Multivariable calculus

Expansions of functions: Taylor's and Maclaurin's series - Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Expand the given function as series of Taylor's and Maclaurin's (K3)
- Find partial derivatives numerically and symbolically and use them to analyze and interpret theway a function varies. (K3)
- Acquire the Knowledge in maxima and minima of functions of several variables (K1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables(K3)

Unit IV: Multiple Integrals

Double Integrals: change of order of integration, double integrals in polar coordinates, areas enclosedby plane curves.
Triple Integral: Evaluation of triple integrals, change of variables

Learning Outcomes:

At the end of this unit, the student will be able to

- evaluate double integrals of functions of several variables in two dimensions using Cartesian andpolar coordinates (K3)
- apply double integration techniques in evaluating areas bounded by a region (K4)

Unit V: Special Functions

Beta and Gamma functions and their properties, relation between beta and gamma functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Conclude the use of special functions in multiple integrals (K3)

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42/e, 2012.

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9/e, 2013.
2. B.V. RAMANA, Higher Engineering Mathematics, Tata McGraw Hill, 2007.

Course Outcomes:

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

1. develop the use of matrix algebra techniques that is needed by engineers for practicalapplications (K3)
2. familiarize with functions of several variables which is useful in optimization (K3)
3. learn important tools of calculus in higher dimensions. Students will become familiar withdouble integral(K3)
4. familiarize with triple integral and also learn the utilization of special functions

I SEMESTER	L	T	P	C
	3	-	-	3
19BS1T01 – ENGINEERING PHYSICS				

COURSE OUTCOMES

After completion of course student able to:

1. Describe Basic crystal systems and determination of crystal structures
2. Explain Magnetic and Dielectric Materials properties
3. Describe Concept of Magnetic Induction and Super Conducting properties
4. Explain Pure & Doped Semiconductor materials for better utility
5. Describe Optical fibers and Optical properties of materials and their applications

SYLLABUS

UNIT –I: CRYSTAL STRUCTURE AND X-RAY

DIFFRACTIONCRYSTAL STRUCTURE:

Introduction – Space lattice – Basis – Unit Cell – Lattice parameters – Bravais lattices – Crystal systems– Structures and packing fractions of SC, BCC and FCC.

X- RAY DIFFRACTION:
Directions in crystals- planes in crystals- Miller indices and procedure to find Miller indices- Various planes in crystals- Separation between successive (h k l) planes-Bragg's law-Bragg's Spectrometer.

Learning Outcomes: At the end of this unit, the students will be able to

- **Explain** the seven crystal systems
- **Interpret** the crystal structure based on Bragg's law

UNIT – II: MAGNETIC AND DIELECTRIC PROPERTIES

MAGNETIC PROPERTIES: Introduction-Magnetic permeability – Magnetization – Relation between three magnetic vectors - Origin of magnetic moment – Classification of Magnetic materials- Dia, Para, Ferro, Anti-Ferro and Ferri-magnetism – Hysteresis- soft and Hard Magnetic materials.

DIELECTRIC PROPERTIES: Introduction-Dielectric constant- Relation between three electric vectors-Electronic and ionic polarizations (Quantitative) - orientation polarizations (Qualitative) - Internal fields in solids- Clausius - Mossotti equation.

Learning Outcomes: At the end of this unit, the students will be able to

- **Classify** the magnetic materials into dia, para, ferro, anti ferro and ferri
- **Explain** the importance of hysteresis
- **Explain** the concept of polarization in dielectric materials.
- **Summarize** various types of polarization of dielectrics .
- **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics.

UNIT-III: ELECTROMAGNETIC WAVES AND SUPERCONDUCTIVITY

ELECTROMAGNETIC WAVES: Introduction-Electric flux –magnetic flux- Gauss law in electrostatics- Gauss law in magnetostatics- Ampere's law - Biot-Savart's law-Magnetic Induction due to current carrying circular loop- Faraday's law - Maxwell's equations.

SUPERCONDUCTIVITY: General and Thermal properties –Meissner effect – Type-I and Type-II superconductors – Flux quantization – BCS Theory of Superconductivity - Josephson effects – Applications of Superconductors.

Learning Outcomes: At the end of this unit, the students will be able to

- **Illustrate** the concept of electro magnetism based on fundamental laws of electro magnetism
- **Explain** Maxwell's equations
- **Summarize** various properties and applications of superconductors

UNIT-IV: PHYSICS OF SEMICONDUCTORS:

Classification of solids based on band theory - Intrinsic semiconductors- density of charge carriers- Equation for conductivity – Extrinsic semiconductors- P-type and N-type- density of charge carriers- Drift and diffusion – Einstein's equation – Hall Effect- Hall coefficient – Applications of Hall effect– direct & indirect band gap semiconductors.

Learning Outcomes: At the end of this unit, the students will be able to

- **Summarize** various types of solids based on band theory.
- **Outline** the properties of n-type and p-type semiconductors.
- **Identify** the type of semiconductor using Hall effect

UNIT-V: LASERS AND OPTICAL FIBERS

LASERS: Introduction– Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion - Three level and four level laser pumping schemes - Rubylaser – Helium-Neon laser- Applications of Laser.

FIBER OPTICS: Introduction to Optical fibers- Critical angle of propagation- Total internal reflection- Acceptance angle and acceptance cone- Numerical aperture- Classification of optical fibers based on refractive index profile-Classification of optical fibers based on modes- Applications of optical fibers.

Learning Outcomes: At the end of this unit, the students will be able to

- **Design** various types of lasers
- **Explain** the principle and propagation of light through Optical fibers
- **Discuss** the application of lasers and Optical fibers

TEXT BOOK:

M. N. Avadhanulu, P.G. Kshirasagar & TVS Arun Murthy , A text book of "EngineeringPhysics", S Chand publications, 11th Edition 2019.

REFERENCE BOOKS:

1. Shatendra Sharma and Jyotsna Sharma , Engineering Physics, Pearson Education, 2018.

I SEMESTER	L	T	P	C
	3	0	0	3
19CS1T01: PROBLEM SOLVING AND PROGRAMMING USING C				

Course Outcomes:

At the end of the Course, Student will be able to:

CO1:Illustrate the Fundamental concepts of Computers and basics of computer programming.
CO2:Use Control Structures and Arrays in solving complex problems.
CO3:Develop modular program aspects and Strings fundamentals.
CO4:Demonstrate the ideas of pointers usage.
CO5:Solve real world problems using the concept of Structures, Unions and File operations.

UNIT-I

INTRODUCTION TO COMPUTER PROBLEM SOLVING: Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

UNIT-II

INTRODUCTION TO C PROGRAMMING: Introduction, Structure of a C Program, Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements, Operators, Type Conversion.

CONTROL FLOW, RELATIONAL EXPRESSIONS: Conditional Branching Statements: if, if-else, if-else–if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

UNIT-III

ARRAYS: Introduction, Operations on Arrays, Arrays as Function Arguments, Two dimensional Arrays, Multi-dimensional arrays.

POINTERS: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.

UNIT-IV

FUNCTIONS: Introduction, Function Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Variable Storage Classes,Recursion.

STRINGS: String Fundamentals, String Processing with and without Library Functions, Pointers and Strings.

UNIT-V

STRUCTURES, UNIONS, BIT FIELDS: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type –enum variables, Using Typedef keyword, Bit Fields.

FILES: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

TEXT BOOKS:

1. R. G. Dromey,How to solve it by Computer, Pearson Education.
2. ReemaThareja Computer Programming, , Oxford University Press.

REFERENCE BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. Ajay Mittal, Programming In C A-Practial Approach, Pearson.
3. Forouzan, Gilberg, Cengage. C Programming – A Problem Solving Approach,
4. Dennis Richie And Brian Kernighan, The C Programming Language, Pearson Education.
5. Ashok Kamthane Programming In C, Second Edition, Pearson Publication.
6. YaswanthKanetkar,Let us C , 16th Edition,BPB Publication.

I SEMESTER	L	T	P	C
	2	-	2	3
19ME1T01 - ENGINEERING GRAPHICS				

COURSE OBJECTIVE

Engineering drawing is the principle method of communication for engineers; the objective is to introduce the students, the techniques of constructing the various types of polygons, curves. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

COURSE OUTCOMES: Students are able to

CO1: Construct polygons, conics, cycloids, involutes. (K3)

CO2: Draw the orthographic projections of points, lines in different positions. (K2)

CO3: Draw the orthographic projections of plane surfaces in different positions. (K2)

CO4: Draw the orthographic projections of solids like prisms, cylinder, pyramids and cone. (K2)

CO5: Convert Isometric views to orthographic views and vice-versa and also visualize 2D & 3D objects using Auto CAD. (K3)

UNIT I

Polygons: Constructing regular polygons by general methods, describing polygons on circles.

Curves: Parabola, Ellipse and Hyperbola by Eccentricity method, Cycloid, Epi-cycloid and Hypo-cycloid and Involutes.

UNIT II

Orthographic Projections: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane. Projections of straight lines inclined to both the planes, determination of true lengths, and angle of inclination.

UNIT III

Projections of Planes: regular planes perpendicular and parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

UNIT IV

Projections of Solids: Prisms, Pyramids, Cone and Cylinder, Simple positions of solids and Axis of the Solid parallel to one plane and inclined to other plane.

UNIT V

Isometric Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

CAD: Fundamentals of AutoCAD - For Polygons, Creating 2d And 3d Drawings.

Using Auto CAD: Computer Aided Design, Drawing practice using Auto CAD simple figures like polygons, creating 2D&3D drawings of objects using Auto CAD.

Note: In the End Examination there will be no question from CAD.

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications 2016
2. Engineering Drawing + AutoCAD by K. Venugopal, V. Prabhu Raja, New Age 2010

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers 2016
2. Engineering Graphics for Degree by K.C. John, PHI Publishers 2009
3. Engineering Graphics by PI Varghese, McGrawHill Publishers 2013

I SEMESTER	L	T	P	C
	-	-	3	1.5
19CS1L02 - IT WORKSHOP				

COURSE OUTCOMES:

At the end of the Course, Student will be able to:

CO1: Identify the components of a personal computer and Install Operating System.

CO2:Send email messages (with or without attachments)

CO3:Prepare their own Presentation / Documentation using Office Tools

CO4:Create Interactive Visual Programs Using Scratch.

CO5:Develop Static web site Applications

WEEK	TOPIC
1	**KNOWING OF COMPUTER** **Identification of peripherals of a PC, Laptop, and Smart Phones:** Prepare a report containing the block diagram along with the configuration of each component and its functionality, Input/ Output devices, I/O ports and interfaces, main memory, cache memory and secondary storage technologies, digital storage basics, networking components and speeds.
2	**OPERATING SYSTEMS** Functions of OS, Types, **OS simple setting** : Changing system date and time, display properties, to add or remove a window component and changing mouse properties **File and Directory Management** : Creating and renaming of files and directories, **MS-DOS Commands**
3	**INTERNET SERVICES** Web Browser usage and **Advanced settings** like LAN, Proxy, Content, Privacy, Security, Cookies, Extensions/ Plug-in**, Antivirus installation,** Configuring a firewall, blocking pop-ups ,**Email** creation and usage.
4	Practice on **Microsoft-Word**
5	Practice on **Microsoft-PowerPoint**
6	Practice on **Microsoft-Excel**
7	Creating pdf documents.
8	**CLOUD BASED COLLABORATION TOOLS** Store, sync, and share files with ease in the cloud using Google Drive Manage event registrations, create quizzes, and analyze responses using Google Forms
9&10	**STATIC WEB PAGE DESIGNING** Basic HTML Tags,Table Tags,List Tags,Image Tags, Forms

I SEMESTER	L	T	P	C
	-	-	3	1.5
19BS1L01 - ENGINEERING PHYSICS LAB				

COURSE OUTCOMES

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

CO1: Demonstrate the basic knowledge to know the frequency of a vibrator, hall coefficient, (K3)

CO2: Attain knowledge to verify some of the properties of physical optics. (K4)

CO3: Develop skills to plot various characteristic curves and to calculate the physical properties of given materials. (K4)

CO4: Calculate some the properties of semiconducting materials. (K2)

STUDENT HAS TO DO ANY TEN OF THE FOLLOWING

1. Determination of wavelength of Laser using diffraction grating.
2. Determination of Numerical Aperture and Acceptance angle of an Optical Fiber.
3. Determination of the charge carrier density by using Hall Effect.
4. Determination of the Band Gap of a Semiconductor using a p-n junction diode.
5. Study of Characteristic curves (l/V) of a Zener diode to determine its Breakdown voltage.
6. Determination of Temperature coefficient of resistance of a Thermistor by using its Characteristiccurve.
7. Study the variation of intensity of magnetic field along the axis of a circular current carrying coil byusing Stewart and Gee's experiment.
8. Study of Characteristic curves (l/V) of a P-N diode.
9. Determine Frequency of given electrically driven tuning fork in Transverse and Longitudinalmodes by using Melde's apparatus
10. Determine frequency of A.C. supply by using Sonometer.
11. Determination of the Time Constant for a C-R Circuit
12. Determination of the Planck's constant by using Photo-Cell
13. Determination of dielectric constant of a given material

I SEMESTER	L	T	P	C
	0	0	3	1.5
19CS1L01: C PROGRAMMING LAB				

Course Outcomes:
CO1:Implement basic programs in C and design flowcharts in Raptor.
CO2:Use Conditional and Iterative statements to solve real time scenarios in C.
CO3:Implement the concept of Arrays and Modularity and Strings.
CO4:Apply the Dynamic Memory Allocation functions using pointers.
CO5:Develop programs using structures, and Files.

List of Experiments:

1. Introduction to Algorithms and Flowcharts

1.1) Implement Algorithm Development for Exchange the values of Two numbers.
1.2) Given a set of n student's examination marks (in the range 0-100) make a count of the number of students that passed the examination. A Pass is awarded for all of 50 and above.
1.3) Given a set of n numbers design an algorithm that adds these numbers and returns the resultantsum. Assume N is greater than or equal to zero.

2. Introduction to C Programming

2.1) Exposure to Turbo C, Code Blocks IDE, Dev C++, Falcon C++.
2.2) Writing simple programs using printf(), scanf() .

3. Raptor

3.1) Introduction to Raptor.
3.2) Draw a flow chart to find the Sum of 2 numbers.
3.3) Draw a flow chart to find Simple interest.

4. Basic Math

4.1)Write a C Program to convert Celsius to Fahrenheit and vice versa.
4.2) Write a C Program to find largest of three numbers using ternary operator.
4.3) Write a C Program to Calculate area of a Triangle using Heron's formula.

5. Control Flow- I

5.1) Write a C Program to Find Whether the Given Year is a Leap Year or not.
5.2)Write a C program to find the roots of a Quadratic Equation.
5.3) Write a C Program to make a simple Calculator to Add, Subtract, Multiply or Divide UsingSwitch…case.

6. Control Flow- II

6.1) Write a C Program to Find Whether the Given Number is Prime number or not.
6.2) Write a C Program to Find Whether the Given Number is Armstrong Number or not.
6.3) Write a C program to print Floyd Triangle.

7. Control Flow- III

7.1)Write a C program to find the sum of individual digits of a positive integer.
7.2) Write a C program to check whether given number is palindrome or not.
7.3) Write a C program to read two numbers, x and n, and then compute the sum of the geometricprogression $1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$.

Practice Programs:

Write a C program to print all natural numbers from 1 to n. - using while loop

Write a C program to print all natural numbers in reverse (from n to 1). - using while loop
Write a C program to print all alphabets from a to z. - using while loop
Write a C program to print all even numbers between 1 to 100. - using while loop
Write a C program to print sum of all even numbers between 1 to n.
Write a C program to print sum of all odd numbers between 1 to n.
Write a C program to print table of any number.
Write a C program to find first and last digit of any number.
Write a C program to count number of digits in any number.
Write a C program to calculate sum of digits of any number.
Write a C program to calculate product of digits of any number.
Write a C program to swap first and last digits of any number.
Write a C program to enter any number and print its reverse.
Write a C program to enter any number and check whether the number is palindrome or not.
Write a C program to find frequency of each digit in a given integer.
Write a C program to enter any number and print it in words.
Write a C program to print all ASCII character with their values.
Write a C program to enter any number and print all factors of the number.
Write a C program to enter any number and calculate its factorial.
Write a C program to find HCF (GCD) of two numbers.
Write a C program to find LCM of two numbers.
Write a C program to check whether a number is Prime number or not.
Write a C program to check whether a number is Armstrong number or not.
Write a C program to check whether a number is Perfect number or not.
Write a C program to check whether a number is Strong number or not.
Write a C program to print Fibonacci series up to n terms.

8. Arrays

8.1) Write a C program to search an element in the given array (Linear Search).
8.2) Write a C program to perform matrix addition.
8.3) Write a C program to perform matrix multiplication.

Practice Programs:

Write a C program to read and print elements of array.
Write a C program to find sum of all array elements. - using recursion.
Write a C program to find maximum and minimum element in an array. - using recursion.
Write a C program to find second largest element in an array.
Write a C program to copy all elements from an array to another array.
Write a C program to insert an element in an array.
Write a C program to delete an element from an array at specified position.
Write a C program to print all unique elements in the array.
Write a C program to print all negative elements in an array.
Write a C program to count total number of even and odd elements in an array.
Write a C program to count total number of negative elements in an array.
Write a C program to count total number of duplicate elements in an array.
Write a C program to delete all duplicate elements from an array.
Write a C program to count frequency of each element in an array.
Write a C program to merge two array to third array.
Write a C program to find reverse of an array.
Write a C program to convert lowercase string to uppercase.

Write a C program to convert uppercase string to lowercase.

Write a C program to toggle case of each character of a string.

Write a C program to find total number of alphabets, digits or special character in a string.

9. Pointers

9.1) Write a C Program to Perform Addition, Subtraction, Multiplication and Division of two numbers using Command line arguments.

9.2)Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.

9.3) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function.

10. Functions, Array & Pointers

10.1) Write a C Program to demonstrate parameter passing in Functions.

10.2) Write a C Program to find Fibonacci, Factorial of a number with Recursion and without recursion.

10.3) Write a C Program to find the sum of given numbers with arrays and pointers.

Practice Programs:

Program to change the value of constant integer using pointers.

Program to print a string using pointer.

Program to count vowels and consonants in a string using pointer.

Program to read array elements and print with addresses.

11. Strings

11.1) Implementation of string manipulation operations with library function:

a) copy
b) concatenate
c) length
d) compare

11.2) Implementation of string manipulation operations without library function:

a) copy
b) concatenate
c) length
d) compare

11.3) Verify whether the given string is a palindrome or not.

12. Structures

12.1) Write a C Program to Store Information of a book Using Structure.

12.2) Write a C Program to Add Two Complex Numbers by Passing Structure to a Function.

13. Files

13.1) Write a C program to open a file and to print the contents of the file on screen.

13.2) Write a C program to copy content of one file to another file.

13.3) Write a C program to merge two files and store content in another file.

14. Application

Creating structures to capture the student's details save them in file in proper record format, search and prints the student details requested by the user.

Note:Draw the flowcharts using Raptor from Experiment 3 to Experiment 6.

Reference Books:

1. Yashwanth Kanetkar, Let Us C 16th edition, BPB Publications.
2. Ajay Mittal,Programming in C A-Practial Approach, Pearson Education.
3. Dennis Richie and Brian Kernighan, The C programming Language, Pearson Education.
4. K Venugopal, Problem solving using C , 3rdEdition,TMG Publication.

Web Links:

1. https://www.hackerrank.com/
2. https://www.codechef.com/
3. https://www.topcoder.com/
4. https://code-cracker.github.io/
5.https://raptor.martincarlisle.com/
6. https://nptel.ac.in/courses/106105085/2

I SEMESTER	L	T	P	C
	0	0	3	1.5
19HS1L01: ENGLISH PROFICIENCY LAB				

COURSE OUTCOMES

a) Reading Skills.

- Addressing explicit and implicit meaning of a text.
- Understanding the context.
- Learning new words and phrases.
- Using words and phrases in different contexts.

b) Writing Skills:

- Using the basic structure of a sentence.
- Applying relevant writing formats to create paragraphs, essays, letters, E-Mails, reports and presentations.
- Retaining a logical flow while writing.
- Planning and executing an assignment creatively.

c) Interactive skills:

- Analyzing a topic of discussion and relating to it.
- Participating in discussions and influencing them.
- Communicating ideas effectively.
- Presenting ideas coherently within a stipulated time.

d) Life Skills and Core Skills:

- Examining self-attributes and identifying areas that require improvement self-diagnosis, self-motivation.
- Adopting to a given situation and developing a functional approach to find solutions-adaptability, problem-solving.
- Understanding the importance of helping others-community service, enthusiasm.

PRE REQUISITES

The student is expected to have basic knowledge in English language and must be able to write in English. He is also expected to possess fundamental knowledge of general English grammar and vocabulary.

Unit	TOPIC
1	Vowels, Consonants, Pronunciation, Phonetic transcripts
2	Word stress and syllables
3	Rhythm and Intonation
4	Contrastive Stress –Homographs
5	Word Stress : Weak and Strong forms , Stress in compound words

Text Book:

"Infotech" by Maruthi Publications (2019)

Reference Books:

1. Better English Pronunciation by O' Connor
2. Phonetics and Phonology – Peter Roach
3. A Grammar of Spoken English – Harold Palmer
4. English Phonetics – Bansal and Harrison

II SEMESTER	L	T	P	C
	3	0	0	3
19MA2T03: VECTOR CALCULUS & NUMERICAL METHODS				

Course Outcomes:

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

CO1:Solve the differential and partial differential equations related to various engineering fields

CO2:Interpret the physical meaning of scalar and vector point functions and different operators such as del, gradient, curl and divergence

CO3:Estimate the work done against a field, circulation and flux using vector calculus

CO4:Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. Student can solve ordinary differential equations by various numerical techniques.

UNIT- I

ORDINARY DIFFERENTIAL EQUATIONS

Linear differential equations – Bernoulli's equations

Solutions of Non-homogeneous Linear differential equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, $e^{ax}V(x)$ and $x^nV(x)$ – Method of Variation of parameters.

Learning Outcomes:

At the end of this unit, the student will be able to

- identify the essential characteristics of linear differential equations with constant coefficients
- solve the linear differential equations with constant coefficients by appropriate method

UNIT –II

PARTIAL DIFFERENTIAL EQUATIONS OF FIRST ORDER:

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply a range of techniques to find solutions of standard PDEs
- outline the basic properties of standard PDEs

UNIT III

VECTOR DIFFERENTIATION

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply del to Scalar and vector point functions
- illustrate the physical interpretation of Gradient, Divergence and Curl

UNIT IV

VECTOR INTEGRATION

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

Learning Outcomes:

At the end of this unit, the student will be able to

- find the work done in moving a particle along the path over a force field
- evaluate the rates of fluid flow along and across curves
- apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals

UNIT V

NUMERICAL METHODS FOR ALGEBRAIC EQUATIONS AND ORDINARY DIFFERENTIAL EQUATIONS

Numerical Solution to algebraic equations: Solution of polynomial and transcendental equations: bisection method, Newton-Raphson method and Regula-Falsi method

Numerical Solution of Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first order equations.

Learning Outcomes:

After completion of this unit student able to

- find approximate roots of the an equation by using different numerical methods
- solve ordinary differential equations by using different numerical schemes

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna publishers, 2012.

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2013.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

II SEMESTER	L	T	P	C
	3	0	0	3
19BS2T02: ENGINEERING CHEMISTRY				

COURSE OUTCOMES

At the end of semester, the students will be able to

CO1: Explain the impurities present in raw water, problems associated and how to avoid them
CO2: Explain the advantages of Polymers in daily life
CO3: Explain the theory of construction of battery and fuel cells and theories of corrosion and prevention methods.
CO4: Differentiate conventional and non-conventional energy sources and their advantages and disadvantages.
CO5: Identify the usage of advanced materials in day to day life

UNIT I

WATER TECHNOLOGY

Hardness of water-types of hardness-disadvantages of hard water-determination of hardness by EDTA complexometric method. Portable water and its specifications-steps involved in purification of water-chlorination, break point of chlorination. Boiler troubles: Scale and sludge-priming and foaming-boiler corrosion-caustic embrittlement.
Industrial Water Treatment: Softening methods: zeolite process-ion exchange process.
Brackish water treatment (desalination methods): Reverse osmosis - electro dialysis.

Learning Outcomes: At the end of this unit, the students will be able to Explain
The impurities present in raw water, problems associated with them and how to avoid them

UNIT-II

POLYMERS AND COMPOSITE MATERIALS

Polymers-Introduction-Types of polymers-degree of polymerization-functionality-preparation properties and applications of individual polymers-Bakelite-PVC-Poly styrene.

Plastics: Types (thermosetting and thermoplastic)-compounding of plastics-moulding Process (Any Four) - recycling of e-waste.

Rubbers and elastomers: Introduction-natural rubber-vulcanization of rubber-synthetic rubbers-Buna-N, Buna-S.

Composite materials: Fiber reinforced plastics-biodegradable polymers-biomedical polymers-conducting polymers

Learning Outcomes: At the end of this unit, the students will be able to

- **Outline** the properties of polymers and various additives added and different methods of forming plastic materials.
- **Explain** the preparation, properties and applications of some plastic materials.
- **Discuss** natural and synthetic rubbers and their applications.

UNIT III

ELECTRO CHEMICAL CELLS AND CORROSION

Electrochemical Cells

Introduction-single electrode potential-electrochemical cell-electrochemical series and applications. Reference electrodes-standard hydrogen electrode and calomel electrode-construction of glass electrode.

Batteries: Construction, working and cell reaction of primary (dry cell) and Secondary (Pb acid, Ni-Cd, Zinc-Air and Li-ion) battery. Fuel cells (H_2-O_2, Methanol-Air cells).

Corrosion

Defination-theories of corrosion (Chemical and Electrochemical corrosion)-types of corrosion (Galvanic, Differential aeration (waterline and pitting corrosion), stress Corrosion). Factors influencing rate of corrosion-nature of metal-nature of corrosive atmosphere.

Corrosion Prevention methods: Cathodic protection-Sacrificial anodic method-Impressed voltage method. Metallic coatings: Galvanization-Tinning-Electro plating-Electro less plating.

Learning Outcomes: At the end of this unit, the students will be able to

- **Explain** the theory of construction of battery and fuel cells.
- **Categorize** the reasons for corrosion and study some methods of corrosion control.

UNIT IV

CONVENTIONAL AND NONCONVENTIONAL ENERGY RESOURCES

Conventional energy sources

Introduction to fuels-classification and characteristics of fuels-solid, Liquid and gaseous fuels-advantages and disadvantages-calorific value-higher and lower calorific values-construction and working of bomb calorimeter-analysis of coal-proximate and ultimate analysis-numerical problems related to bomb calorimeter, Dulong's formula and coal analysis-petroleum refining-cracking-petrol and diesel knocking-octane number and cetane number-gaseous fuels-Natural gas-CNG-LPG

Non-conventional energy sources

Solar energy: Advantages-disadvantages of solar cells-construction and working of photo voltaic cell-Introduction to hydro power-geo thermal power-tidal and wave power.

Learning Outcomes: At the end of this unit, the students will be able to

- **Differentiate** conventional and non conventional energy sources and their advantages and disadvantages.
- **Explains** energy production by different natural sources

UNIT V

CHEMISTRY OF MATERIALS

Nano materials: Introduction-sol-gel method-characterization by BET, SEM and TEM methods-carbon nanotubes and fullerenes: Types, preparation and applications

Semiconductors:Preparation (Distillation, Zone refining, Czochralski crystal pulling epitaxy, diffusion, ion implantation)-semiconductor devices (P-N junction diode as rectifier, junction transistor)

Cement: Constituents of cement-setting and Hardening of cement, Decay of Cement.

Refractories: Definition of refractory-classification and properties of refractoriness-applications of refractories.

Learning Outcomes: At the end of this unit, the students will be able to

- **Outline** the awareness of materials like nanomaterials and fullerenes and their uses.
- **Explain** the techniques that detect and measure the surface properties of materials.
- **Illustrate** the commonly used industrial materials.

Text Books:

1. N. Y. S. Murthy, V. Anuradha & K. Ramana Rao, A Text Book of Engineering Chemistry, Maruthi Publications, 2018

2. K. Sesha Maheswaramma, Mridula Chugh, A Text Book of Engineering Chemistry, Pearson Publications 2018.

Reference Books:

1. Jain & Jain, Engineering Chemistry,Dhanpat Rai Publishing Company, 2017.

2. Shashi Chawla, Text Book of Engineering Chemistry , Dhanpat Rai & Co. (P) Limited, 2017.

3. Prasanta Rath and Subhendu Chakroborthy, Chemistry ,Cengage publications,2018.

II SEMESTER	L	T	P	C
	3	0	0	3
19CS2T02 : OBJECT ORIENTED PROGRAMMING THROUGH C++				

COURSE OUTCOMES:

At the end of the Course, Student will be able to:
CO1: Proficient in Principles of object oriented technology.
CO2:The Evolution and Purpose of Object Oriented Programming.
CO3:Mastering in basic Object Oriented programming concepts and logic implementations.
CO4:Knowledge in file I/O operations and exceptions
CO5:Ability to identify and implement appropriate Solution for a given Problem.
CO6:Know the terms Object oriented Programming, Class ,Object ,Constructor, Destructor, friend, static, Data Abstraction, Encapsulation, Inheritance, Polymorphism, File I/O, templates,Exceptions and where they are applicable

UNIT I

INTRODUCTION: The Object Oriented Technology, Disadvantages of Conventional Programming, Advantages of OOP, Structure of a C++ Program, Differences between C and C++

INPUT AND OUTPUT IN C++: Streams, Stream Classes Hierarchy, Bit Fields, Manipulators. Tokens in C++, Data Types, Constants, L Value and R Values, Operators in C and C++, Scope Access Operator, Comma Operator, This Operator, Reference Variable, Decision and Loop Statements.

UNIT II

FUNCTIONS IN C++: Passing Arguments to a Function, Default Arguments, Const Arguments, Inputting Default Arguments, Inline Functions, Function Overloading.

CLASSES AND OBJECTS: Class Definition, Declaring Objects, Access specifiers and their scope, Member functions, Outside member functions as inline, Data Hiding or Encapsulation, Memory for Class and Objects, Static Member variables, Static Member Functions, Static Object, Array of Objects, Objects as Function Arguments, Friend Functions, Friend class, Local class, Empty Class, Qualifiers and Nested Classes, Member Function and Non-Member Function.

UNIT III

CONSTRUCTORS AND DESTRUCTORS: Introduction of Constructor, Destructor & Characteristics, Parameterized Constructor, Overloading Constructors, Constructor with Default Arguments, Copy Constructor

OPERATOR OVERLOADING: Introduction of Overloading, Overloading Unary Operators, Constraint on Increment and Decrement Operators, Overloading Binary Operators, Overloading with Friend Functions, Overloading Assignment Operator, Rules for Overloading Operators.

UNIT IV

INHERITANCE: Introduction of Inheritance, Access specifiers, Protected Data with Private Inheritance, Types of Inheritances, Virtual Base Class, Constructors and Destructors in Inheritance, Constructor and Destructor in Derived Class, Advantages and Disadvantages of Inheritance.

POLYMORPHISM: Polymorphism, Types, Pointer and Inheritance, Virtual and Pure Virtual Functions, Abstract Classes.

UNIT V

APPLICATIONS WITH FILES: File Stream Classes, File Opening Modes, File Pointers and Manipulators, Sequential Access Files, Binary and ASCII Files, Random Access Files.

TEMPLATES & EXCEPTION HANDLING

Principles of Exception Handling, Keywords, Exception Handling Mechanism, Multiple Catch Statements, Catching Multiple Exceptions.

Generic Programming with Templates, Need for Templates- Definition of class Templates.

Introduction to STL- Containers, Algorithms, Iterators.

TEXT BOOKS

1. Ashok N Kamthane, Programming in C++, 4th edition,Pearson.

2. B. Stroutstrup, The C++ Programming Language, 4th edition,Pearson Education.

3. Herbert Schildt,The Complete Reference C++, 4th edition,Tata McGraw Hill.

REFERENCES

1. Joyce Farrell, Object Oriented Programming C++, 4th edition ,Cengage.

2. Venugopal, Raj Kumar, Ravi Kumar,Mastering C++ , 2nd edition ,TMH.

3. SouravSahay, Object Oriented Programming with C++, 2nd edition, OXFORD.

LINKS

https://www.geeksforgeeks.org/object-oriented-programming-in-cpp/

https://www.tutorialspoint.com/cplusplus/cpp_object_oriented.htm

II SEMESTER	L	T	P	C
	3	0	0	3
19EE2T02: ELECTRICAL NETWORKS				

Course Outcomes: ***Aftersuccessful completion of this course, students should be able to:***

CO1 : Solve electrical networks using various techniques.
CO2 : Solve electrical networks using network topology concepts.
CO3 : Solve electrical circuits using network theorems with AC and DC excitations.
CO4 : Analyze the behavior of RLC networks for sinusoidal excitation.
CO5 : Analyze magnetic circuits.

UNIT-I

FUNDAMENTALS OF ELECTRICAL CIRCUITS

Active and Passive Components and their V-I Relations - Dependent and IndependentSources- Source Transformation Technique - Network Reduction Techniques-Series, Parallel and Series – Parallel Combination of R, Land C (Each Element Separately)–Star/Delta and Delta/Star Transformation, Nodal Analysis and Mesh Analysis With Dependent and Independent Voltage and Current Sources for Both DC and AC Excitation.

UNIT-II

NETWORK TOPOLOGY

Definition- Graph- Node – Branch – Links – Twigs - Tree, Co-Tree Basic Cut-Set and Basic Tie-Set Matrices for Planar Networks — Duality &Dual Networks.

UNIT-III

SINGLE PHASE A.C CIRCUITS

Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of Representations, J-Notation, R.M.S, Average Values and Form Factor for Different Periodic Wave Forms - Concept of Reactance, Impedance, Susceptance and Admittance-Power Factor and Significance-Real and Reactive Power, Complex Power – Simple Problems.**Resonance:** Resonance-Series, Parallel Circuits, Concept of Band Width and Q Factor.

UNIT-IV

NETWORK THEOREMS WITH DC & AC EXCITATION

Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Millman's Theorem and Compensation Theorem.

UNIT-V

MAGNETIC CIRCUITS

Basic Definition of MMF, Flux and Reluctance, Analogy Between Electrical and Magnetic Circuits, Faraday's Laws of Electromagnetic Induction – Concept of Self and Mutual Inductance, Dot Convention – Coefficient of Coupling and Composite Magnetic Circuit, Analysis of Series and Parallel Magnetic Circuits.

TEXT BOOKS:

1. Charles K.Alexander, Mathew N.O.Sadiku, Fundamentals of Electric Circuits "TataMcGraw-Hill sixth edition-2019.
2. A. Sudhakar and Shyammohan S Palli,Circuits & Networks Analysis & Synthesis by TataMcGraw-Hill Fifth edition-2017.
3. Schaum,3000 Solved Problems in Electrical Circuit solved problem series TataMcGraw-Hill Revised Edition 2018.
4. Chakrabarti, Circuit Theory by A. DanapatRai& Co publisher.Seventh - Revised edition(2018).

REFERENCE BOOKS:

1. William Hayt and Jack E.Kemmerley,Engineering Circuit Analysis by McGraw HillCompany,6th edition ,2013.
2. N.C.Jagan, C.LakshmiNarayana, Network Analysis by BS publications 2nd edition -2017
3. Van Valkenburg, Network Analysis:; Prentice-Hall of India Private Ltd.Third edition, 2019.

II SEMESTER	L	T	P	C
	3	0	0	3
19HS2T01: ENGLISH				

COURSE OUTCOMES

A) Reading Skills

- Addressing explicit and implicit meaning of a text.
- Understanding the context.
- Learning new words and phrases.
- Using words and phrases in different contexts.

B) Writing Skills

- Using the basic structure of a sentence.
- Applying relevant writing formats to create paragraphs, essays, letters, e-mails, reports and presentations.
- Retaining a logical flow while writing.
- Planning and executing an assignment creatively.

C) Interactive skills

- Analyzing a topic of discussion and relating to it.
- Participating in discussions and influencing them.
- Communicating ideas effectively.
- Presenting ideas coherently within a stipulated time.

D) Grammar in context

- Enable the skills of grammar using in a situation
- Identifying the needs of apt grammar in life related situation
- Promoting discourse with grammar effectively

S No	Content
UNIT –I	**Vocabulary Building** **1.1** Video Lesson 1.2.1 Word formation 1.2.2. Root words 1.2.3. Prefixes and Suffixes 1.2.4. Synonyms and Antonyms **1.3 Parts of Speech** **1.4 Note- making, Note-taking**
UNIT -II	**Basic Writing Skills** **2.1** Video Lesson 2.2.1 Basic sentence structure 2.2.2. Clauses and Phrases 2.2.3 Punctuations 2.2.4 Creating coherence 2.2.5 Organizing principles of paragraph documents 2.2.6 Techniques for writing precisely **2.3 Tenses** **2.4 Letter Writing**
UNIT-III	**Identifying Common Errors in Writing** **3.1** Video Lesson 3.2.1 Sub + verb agreement 3.2.2 Noun pronoun agreement 3.2.3 Articles 3.2.4 Preposition 3.2.5 Redundancies

	3.2.6 Clichés **3.3.1 Active - Passive Voice** **3.3.2 Reported Speech** **3.4 Resume Writing**
UNIT-IV	**Nature and Style of sensible Writing** **4.1** Video Lesson 4.2.1 Describing 4.2.2 Classifying 4.2.3 Writing Introduction and conclusion **4.3.1 Conditional Sentences** **4.3.2 Degrees of Comparison** **4.4 Email writing**
UNIT-V	**Writing Practice** **5.1** Video Lesson 5.2.1 Comprehension 5.2.2 Precise writing 5.2.3 Essay Writing **5.3 Simple Compound and Complex Sentences** **5.4 Report Writing**

TEXT BOOK: Building Effective Communication Skills
By Maruti Publications (2019)

II SEMESTER	L	T	P	C
	0	0	3	1.5
19ME2L01 : ENGINEERING WORKSHOP				

COURSE OUTCOMES: Students will be able to

CO1: Model and Develop various basic prototypes in Carpentry trade [K3]

CO2: Model and Develop various basic prototypes in Fitting trade [K3]

CO3: Perform Various Forging Operations [K3]

CO4: Perform various House Wiring Techniques. [K3]

CO5: Develop various basic prototypes in the trade of Sheet metal. [K3]

NOTE: At least **Two** Exercises to be done from each trade.

TRADE:

I. CARPENTRY:

1. CROSS LAP JOINT 2. DOVETAIL JOINT 3. MORTISE and TENNON JOINT

II. FITTING:

1. SQUARE FIT 2. V-FIT 3. HALF ROUND FIT

III. FORGING:

1. ROUND ROD TO SQUARE
2. S-HOOK
3. ROUND ROD TO SQUARE HEADED BOLT

IV. HOUSE WIRING:

1. PARALLEL/SERIES CONNECTION OF THREE BULBS
2. STAIRCASE WIRING
3. FLOURESCENT LAMP FITTING

V. SHEET METAL:

1. SQUARE TRAY 2. HOLLOW CYLINDER 3. OPEN SCOOP

II SEMESTER	L	T	P	C
	0	0	3	1.5
19BS2L02: ENGINEERING CHEMISTRY LAB				

COURSE OUTCOMES:

Students are able to

CO1:Identify the concentration of given solution by different methods of chemical analysis (**K3**)

CO2:Analyze the water purity by checking hardness, DO and Acidity. (**K4**)

CO3:Estimate the Cu^{+2}, Fe^{+3}, Ca^{+2}, Mg^{+2} ions and Ascorbic acid present in given solution. (**K4**)

CO4:Identify the pour and cloud point of lubricants. **(K3)**

CO5:Understand the principles of conductometric and potentiometric titrations. ($\mathbf{K_2}$)

1. Estimation of HCl using standard Na_2CO_3 through acid-base titration.
2. Estimate the total hardness of water using standardized EDTA solution through complexometric titration.
3. Estimation of $KMnO_4$ using standard $H_2C_2O_4$ through redox titration method.
4. Estimation of Dissolved Oxygen in given water sample by Wrinkler's Method
5. Determination of ferric (Fe^{+3}) ions using standard KCr_2O_7 solution
6. Determination of copper (II) using standard hypo solution.
7. Estimation of strong acid by using strong base through conductometric titration method.
8. Estimation of strong acid by using strong base through potentiometric titration method.
9. Preparation of polymer (Demo).
10. Determination of Vitamin 'C'.
11. Determination of Pour and Cloud Point of lubricating oils

Reference Books

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.

II SEMESTER	L	T	P	C
	0	0	3	1.5
19CS2L03: C++ Programming Lab				

COURSE OUTCOMES:

At the end of the Course, Student will be able to:
CO1: Able to differentiate structure oriented programming and object oriented programming.
CO2:Able to understand and apply various object oriented features.
CO3: Able to know concepts in operator overloading, function overloading & polymorphism.
CO4: Able to write, compile and debug programs in C++ language.
CO5:Design programs involving constructors, destructors.
CO6: To implement the concept of files, templates and exceptions.

EXERCISE-1(BASICS)

A. Write a CPP Program to demonstrate the structure of a C++ program.
B. Write a CPP Program to display the names of header files, definitions and list of functions supported.
C. Write a program to show the base of a numeric value of a variable using **Hex, Oct** and **Dec** manipulator functions.
D. Write a CPP Program to use of the standard manipulators normally used in the stream classes.
E. Write a CPP Program to demonstrate the usage of bit fields.
F. Write a CPP Program to define constant pointer and pointer to constant and perform possible operations.
G. Write a CPP Program access a variable in different scopes by using scope resolution operator and the use of comma operator.

EXERCISE-2(CLASSES & OBJECTS)

A. Write a CPP Program to swap two numbers using call by value, call by address, call by reference and return by reference.
B. Write a CPP Program to calculate square and cube of a number using inline functions and macros. (Demonstrate the use of inline functions compared to macros).
C. Write a CPP Program to find the area of a rectangle, a triangle and surface area of a sphere using function overloading.
D. Write a CPP Program to declare all members of a class as public, Access the members using objects. (Use public, protected, private).
E. Write a CPP Program to access the member functions inside and outside a class.
F. Write a CPP Program to access private data using non-member functions. (Use friend function).
G. Write a CPP Program to pass objects to functions by pass by value method.
H. Write a CPP Program to declare main () function as member function and overload it.

EXERCISE-3(CONSTRUCTORS AND OPERATOR OVER LOADING)

A. Write a CPP Program to show that "for each object constructors is called separately" and read the values through keyboard (Use Constructor).
B. Write a CPP Program to create constructor with arguments and pass the arguments to constructor.
C. Write a CPP Program to create object and release them using destructor.
D. Write a CPP Program to perform addition, subtraction, multiplication of two objects using operator keyword.
E. Write a CPP Program to overload unary and binary operator overloading with friend function.

EXERCISE-4(INHERITANCE AND POLYMORPHISM)

A. Write a CPP Program to derive a class publicly from base class. Declare base class members under public, private and protected.
B. Write a CPP Program to derive single and multiple inheritances.
C. Write a CPP Program to declare virtual base class. Derive a class using two virtual classes.
D. Write a CPP Program to implementation of Virtual Function.
E. Write a CPP Program to Implementation of Pure Virtual Function.

EXERCISE- 5(FILES, TEMPLATES AND EXCEPTION HANDLING)

A. Write a CPP Program to write and read text in a file. Use ofstream and ifstream classes.
B. Write a CPP Program to open a file for writing and reading purpose. Use open () function.
C. Write a CPP Program write text in a file. Read the text from the file from EOF. Display the contents in reverse order.
D. Write a CPP Program to demonstrate that the data is read from file using ASCII format.
E. Write a CPP Program to find the factorial of a number. Throw multiple exceptions and define multiple catch statements to handle exceptions.
F. Write a C++ Program to illustrate template class

Practice Programms

1. Write C++ Program to Create Floyd's Triangle
2. Write a C++ program Add Two Matrices using Multi-dimensional Arrays
3. Write a C++ program Multiply Matrix by passing it to a Function

To perform this task three functions are made:

To take matrix elements from user

To multiply two matrix

To display the resultant matrix after multiplication

4. Write a C++ program to create a class for student to get and print details of N students.
(C++ program to demonstrate example of array of objects.)
5. Write a C++ program to convert time from HH:MM:SS format to seconds using class
6. Write a C++ program to convert time from seconds to HH:MM:SS format using class
7. Write a C++ program to define a class employee having members Emp-id, Emp-name, basic salary and functions accept() and display(). Calculate DA=25% of basic salary,

HRA=800, I-tax=15% of basic salary. Display the pay slip using appropriate output format.

1) To accept the data

2) To display the data

8. Write a C++ Program to check prime Number or not using class

9. To create a class staff having fields: Staff-id , name, salary and functions accept() and display(). Calculate DA=25% of basic salary, HRA=800, I-tax=15% of basic salary. Display the pay slip using appropriate output format.

1) To accept the data

2) To display the data

3) To sort the data by name

10. To define a class to represent a bank account. Include the following members:

Data members:

1) Name of the depositor

2) Account number

3) Type of account

4) Balance amount in the account.

Member functions:

1) To assign initial values

2) To deposit an amount

3) To withdraw an amount after checking the balance

4) To display name and balance.

11. To create a class for an electricity board that charges the following rates to users

a) For first 100 units : 40p per unit

b) For next 200 units : 50p per unit

c) Beyond 300 units : 60p per unit

All users are charged a minimum of Rs.500. If the total cost is more than Rs.250.00 then an additional charges of 15% are added.

Write a C++ program using class to read the names of users & number of units consumed & print out the charges with names.

12. Write C++ program to demonstrate Overloading new and delete operator

13. Write C++ program to compare two Strings using Operator Overloading

14. Write C++ Program to concatenate two strings using Operator Overloading

15. Write a C++ Program to Find the Number of Vowels, Consonants,Digits and White Spaces in a String

16. Write a C++ Program to remove all Characters in a String except Alphabets.

17. Write a C++ Program to Find the Frequency of Characters in a String

18) Write C++ Program for remove all duplicates from the input string. Print all the duplicates in the input string.

19. Write C++ Program for remove characters from the first string which is present in the second string

20. Write C++ Program to check if strings are rotations of each other or not

21. Write C++ Program to read a string .Add the same string in the reverse order to the end of the same string.

22. Write a C++ program to read a string. Change the first letter of every capital word.

23. Write C++ program to declare string objects .Perform assignment and concatenation with the string objects.

24. Write C++ program to perform string operations using string library functions.

25. Write C++ Program for return maximum occurring character in the input string

26. Write C++ program using string manipulating functions.

27. Write a C++ Program to Implement Stack in STL using the following

    1. Insert Element into the Stack
    2. Delete Element from the Stack
    3. Size of the Stack
    4. Top Element of the Stack
    5. Exit

28. Write a C++ Program to Implement String in STL using following

    1. Insert Substring in a String
    2. Erase Substring from a String
    3. Append Substring to a String
    4. Replace the String with a Substring
    5. Size of the String
    6. Find substring in a String
    7. Display the String
    8. Exit

29. Write a C++ Program to Implement Array in STL using following

    1. Insert Element into the Array
    2. Size of the array
    3. Front Element of Array
    4. Element of Array
    5. Display elements of the Array
    6. Exit

30. Write C++ program to implement Bubble Sort using templates in C++

II SEMESTER	L	T	P	C
	0	0	3	1.5
19HS2L02: ENGLISH COMMUNICATION SKILLS LAB				

COURSE OUTCOMES:

a) Reading Skills.
- Addressing explicit and implicit meaning of a text.
- Understanding the context.
- Learning new words and phrases.
- Using words and phrases in different contexts.

b) Writing Skills:
- Using the basic structure of a sentence.
- Applying relevant writing formats to create paragraphs, essays, letters, E-Mails, reports and presentations.
- Retaining a logical flow while writing.
- Planning and executing an assignment creatively.

c) Interactive skills:
- Analyzing a topic of discussion and relating to it.
- Participating in discussions and influencing them.
- Communicating ideas effectively.
- Presenting ideas coherently within a stipulated time.

d) Life Skills and Core Skills:
- Examining self-attributes and identifying areas that require improvement self-diagnosis, self-motivation.
- Adopting to a given situation and developing a functional approach to find solutions-adaptability, problem-solving.
- Understanding the importance of helping others-community service, enthusiasm.

PRE REQUISITES

The student is expected to have basic knowledge in English language and must be able to write in English. He is also expected to possess fundamental knowledge of general English grammar and vocabulary.

UNIT	TOPIC
1	Oral Activity : JAM, Hypothetical situations, self / peer profile, Common errors in pronunciation, Neutralizing Accent
2	Oral Activity : Telephonic Etiquette, Role plays, Poster presentations and e-mail Writing
3	Oral Activity : Oral Presentation Skills, Public Speaking Data Interpretation
4	Oral Activity : Group Discussion: Do's and Don'ts –Types, Modalities
5	Oral Activity : Interview Skills: Preparatory Techniques, FAQ, Mock Interviews Pronunciation : Connected speech (pausing, tempo, tone, fluency etc.,)

Text Book:

"Infotech" by Maruthi Publications (2019)

Reference Books:

1. How to Face Interviews – by Clive Fletchers
2. The 7 Habits of Highly Effective People – by Stephen Covey.

SEMESTER-III	L	T	P	C
	3	0	0	3
19MA3T07: COMPLEX VARIABLES AND RANDOM PROCESS				

COURSE OUTCOMES:

Students are able to

CO1:know the fundamentals of the theory of analytic functions

CO2:know the applications of the theory of analytic functions to complex integration.

CO3:expand the given function in Tailors series, Maclaurin's series and Laurent's series. Finding residues at singular points, able to evaluate integrals.construct the probability distribution function of a random variable

UNIT-I

FUNCTIONS OF A COMPLEX VARIABLE

Continuity – Differentiability – Analyticity – properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thomson method.

Learning Outcomes:

After the completion of this unit student will be able to

- define continuity, differentiability and analyticity for complex functions(K1)
- apply Cauchy's Riemann equations to complex functions in order to determine whether a given continuous function is analytic (K3)

UNIT-II

COMPLEX POWER SERIES

Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series.(Only statements) and related problems. Singularities

Learning Outcomes:

After the completion of this unit student will be able to

- evaluate the Taylors and Laurent expansion of simple functions (K3)
- determine the nature of the singularities (K3)

UNIT-III

COMPLEX INTEGRATION AND RESIDUE

Cauchy's theorem – Cauchy's integral formula – Generalized integral formula (Only statements) and related problems. Evaluation of residue– Residue theorem (Statement only) and related problems.

Learning Outcomes:

After the completion of this unit student will be able to

- evaluate a contour integral using Cauchy's theorem and Cauchy's integral formula (K3)
- make use of the Cauchy's residue theorem to evaluate certain integrals (K3)

UNIT-IV

THE RANDOM VARIABLE AND ITS DISTRIBUTIONS

The Random Variable Concept: Definition of a Random Variable – Conditions for a Function to be a Random Variable - Discrete Random Variables –Distribution Function – Binomial, Poisson Distributions Continuous Random variables- Distribution Function- Gaussian, Exponential distributions.

Learning Outcomes:

After the completion of this unit student will be able to

- calculate probability mass function, density function of a discrete and continuous random variables
- calculate the cumulative distribution functions for discrete and continuous random variables.

UNIT-V

OPERATION ON ONE RANDOM VARIABLE

Expectation: Expected value of a random variable – Expected Value of a Function of a Random Variable. Moments: Moments about the origin - Central Moments - Variance -Functions that give Moments: Moment generating function.

Two Random Variables:

Introduction, vector random variables, Joint distribution and its properties- joint distribution function, properties of joint distributions, marginal distributions.

Learning Outcomes:

After the completion of this unit student will be able to

- Calculate the expected value, variance , moments , MGF, of a discrete and continuous random variables
- Define vector random variables, Joint distribution and marginal distributions.

1. .

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna Publishers, 2012.
2. Peytoon Z peebles,Probability, Random variables & Random Signal Principles –TMH, 4th Edition 2001.

References:

1. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill, 2007
2. S.Chand,Complex variables & Statistical Methods , S.Chand publications
3. K. Murugesan, P. Gurusamy,Probability & Statistics by Anuradha Publications

SEMESTER-III	L	T	P	C
	3	0	0	3
19EC3T01: ELECTRONIC CIRCUITS-I				

COURSE OUTCOMES

After completion of the course students are able to

CO1: Explain the characteristics of semi conductors and distinguish different types of junction diodes. (K2)

CO2: **Compare and analyze different types of Rectifiers and Filters.(K4)**

CO3: Describe the characteristics of Transistors, FET and biasing. (K1)

CO4: Construct the wave shaping circuits of non sinusoidal signals. (K3)

UNIT-I

SEMICONDUCTOR DIODES:

Band structure of pn junction, current components, Quantitative theory of pn diode, Volt-ampere characteristics and its temperature dependence, Transition and diffusion capacitance of p-n junction diodes, Breakdown of junctions on reverse bias, Zener and Avalanche breakdowns,special Semiconductor Diodes Construction, operation and characteristics of all the above diodes is required to be considered.Diode as a Switch.

UNIT-II

RECTIFIERS AND FILTERS:

Rectifiers: Half wave, full wave: center tap and bridge type, analysis for different parameters: PIV, TUF, efficiency, ripple factor, regulation, etc. Filters: Need of filters, Types: Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L- section filter, Pi- section filter, Multiple L- section filter, analysis for ripple factor and regulation.and comparison

UNIT-III

JUNCTION TRANSISTOR CHARACTERISTICS AND BIASING

PNPandNPN junction transistors, Characteristics of the current flow across the base regions, Minority and majority carrier profiles, Transistor as a device in CB, CE and CC configurations, and their characteristics. The operating Point, DC & AC load lines, Fixed Bias and problems, Collector Feedback Bias, Emitter Feed Back Bias, Self Bias and problems, Stabilization, various stabilization circuits, Thermal runaway and thermal stability.Transistor as a Switch

UNIT–IV

FET & MOSFET

FETtypes, construction, operation, characteristics, parameters, MOSFET-construction, characteristics and comparative study of Enhancement and Depletion MOSFET (P-channel& N-channel).Comparison between JFET and MOSFET.FET & MOSFET BIASING: Introduction, Fixed-Bias configuration, Self-Bias Configuration Voltage- Divider Biasing and stabilization. Relevant problems.

UNIT-V

WAVE SHAPING CIRCUITS:

Low pass & high pass RC circuits (square & step response), High pass RC circuit as a

Differentiator, Low passes RC circuit as integrator.

Clipping circuits: Classification, diode clippers, transistor clippers, Transfer characteristics, Design & analysis of clipper circuits.

Clamping circuits: Classification, clamping operations, Clamping circuit theorem, practical clamping circuits.

TEXT BOOKS:

1. S. Salivahanan, N. Suresh Kumar and A. Vallava Raj, "Electronic Devices and circuits", TMH, 2nd Edition 2008.
2. J. Millman&C.Halkias -'Electronic devices & circuits'-IInd Edition- Tata McGraw Hill Publication.
3. Robert L Boylestead and Louis Nashelsky, "Electronic Devices and circuit theory", Pearson, Tenth edition 2009.

REFERENCES BOOKS:

1. David A. Bell –'Electronic devices & circuits'- IVth Edition- Prentice- Hall India
2. Robert L. Boylsted, Louis Nashelsky- 'Electronic devices & circuit theory'- (IX^{th}edition)- Pearson Education.

SEMESTER-III	L	T	P	C
	3	0	0	3
19EC3T02: DIGITAL ELECTRONICS				

COURSE OUTCOMES:

After completion of the course students are able to

CO1: Describe the function of basic gates and universal gates.(K1)

CO2: Analyze the behavior of various combinational circuits.(K4)

CO3: Explain the behavior of various sequential circuits (K2,K4)

CO4: Demonstrate Digital systems using combinational and/or sequential circuits (K3)

UNIT-I

BASICS OF DIGITAL SYSTEMS:

Introduction to Number Systems: Number base conversions, Binary to Octal, Octal to Binary, Binary to Hexadecimal, Hexadecimal to Binary, Unsigned and, Signed Binary arithmetic numbers., Binary codes, Special codes like Gray codes, Excess- 3 codes, 2-4-2-1 codes, Different types of code conversions like Binary to Gray codes and Gray codes to Binary codes.

UNIT-II

SIMPLIFICATION OF BOOLEAN FUNCTIONS:

Minimization Techniques: Boolean postulates and laws – De-Morgan‟s Theorem – Principle of Duality, Applications of Boolean laws – Boolean expression – Minimization of Boolean expressions — Min-term – Max term – Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization- 3,4 and 5 variables. NAND and NOR implementations, Implementation of different logic circuits using only NAND and NOR gates.

UNIT-III

ARITHMATIC LOGIC CIRCUITS:

Half-adder , Full-adder, N- bit Ripple adder, Carry look ahead adder, Carry Save Adder, Parallel-adder , Half-Subtractor, Full-Subtractor, Full-Adder/Subtractor, BCD adder, Multipliers like Array-multipliers, Serial-multipler, Parallel-multiplier, 1-bitMagnitude Comparators, Cascading of N bit Magnitude comparator using 1- bit Magnitude Comparators .

UNIT-IV

COMBINATIONAL LOGIC CIRCUITS:

Decoders, Encoders, Binary Multiplexer, De-multiplexers, Memory devices: Random Access Memory, Read only Memory, Programmable Read only Memory, EPROM, EEPROM, Flash ROM, Programmable Logic Devices: Programmable Logic Array, Programmable Array Logic. Complex Programmable Logic Devices & Field Programmable Gate Arrays.

UNIT-V

SEQUENTIAL CIRCUITS:

Latches, Flip-Flops, truth tables and excitation tables. Flip-Flop conversions, Excitation tables, Synchronous and Asynchronous, Counters(Up-Down), Design of N bit counters, Ripple counter, Differences between Synchronous & Asynchronous, Counters, Ring counter and Johnson counter. Different types of Registers, Shift Registers, FSM –Mealy and More models.

TEXTBOOKS:

1. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.

REFERENCES:

1. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.

SEMESTER-III	L	T	P	C
	3	1	0	4
19EC3T03: SIGNALS AND SYSTEMS				

COURSE OUTCOMES

After completion of the course students are able to

CO1:Describe the signal fundamentals in terms of types and how to represent the various signals. (K1)

CO2:Explain the concept of Fourier series and Fourier transforms to determine the signal and system characteristics. (K2, K4)

CO3:Demonstrate the concept of sampling theorem, convolution and correlation and also signal transmission through linear systems. (K3)

CO4:Demonstrate the concept of ROC (Region Of Convergence) using Laplace and Z- Transforms to analyze the continuous and discrete time systems. (K3, K4)

UNIT- I

INTRODUCTION TO SIGNALS AND SYSTEMS

Introduction to Signals: Continuous time signals and Discrete time signals- Periodic and Aperiodic signals- Even and Odd signals- Energy and Power signals- Deterministic and Random signals-Complex Exponential and Sinusoidal signals, Standard Functions - Unit impulse and Unit step-Unit ramp signal.

Introduction to Systems: Continuous time systems and Discrete time systems- Linear and Non-Linear systems- Time Invariant and Time Variant systems- Causal and Non-causal system- BIBO system- Systems with and without memory- Recursive and Non Recursive systems-Distortion less system

UNIT-II

FOURIER SERIES AND SAMPLING

Fourier series: Orthogonal Functions-Fourier Series Representation of Continuous-Time Periodic Signals-Properties of Fourier series-Trigonometric and Exponential Fourier series.

Sampling: Sampling Theorem-Time domain and frequency domain statements- Reconstruction of a Signal from its sample- The Effect of under sampling: Aliasing.

UNIT-III

CONVOLUTION, CORRELATION AND LTI SYSTEMS

Convolution and Correlation: Concept of convolution in timedomain and frequency domain, Graphical representation of convolution. Cross correlation and auto correlation of functions, properties of correlation function.

Continuous-Time and Discrete-Time LTI Systems: Convolution Integral and Convolution Sum. Properties of Linear Time-Invariant Systems. Causal LTI Systems described by Differential and Difference Equations.

UNIT-IV

CONTINUOUS-TIME TRANSFORMS

Laplace Transform: Unilateral and bi-lateral Laplace Transforms. ROC, Constraints of ROC, Laplace Transform of standard functions, Properties, Inverse Laplace Transform. Initial and Final Value theorems.

Fourier transform: Unilateral and bi-lateral Fourier Transform- Properties of Fourier transform, The Convolution Property, Parseval's Theorem, The Multiplication Property. Inverse Fourier Transform. Relation between LT and CTFT.

UNIT-V

DISCRETE-TIME TRANSFORMS

Discrete-Time Fourier Transform: Unilateral and bi-lateral DTFT, Properties of DTFT, Convolution Property.

z-Transform: Unilateral and bi-lateral z-transform, ROC, Constraints of ROC, Properties of Z-transforms, Convolution Property, Inverse z-Transform(Direct and Indirect methods) . Initial and Final Value theorems, Relation between DTFT and Z-Transform.

TEXT BOOKS

1. Signals and Systems – A.V.Oppenheim, A.S.Willsky and S.H.Nawab, 2nd Edition, Prentice-Hall India.
2. B.P. Lathi, "Principles of Linear Systems & Signals", Oxford Press, Second Edition 2005.

REFERENCE BOOKS

1. John G. Proakis and Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", PearsonEducation, 3rdedition, 2002.
2. Simon Haykin and Barry Van Veen ,"Signals and Systems", John Wiley & Sons In, 2001.

SEMESTER-III	L	T	P	C
	3	0	0	3
19CS3T02 : DATA STRUCTURES				

COURSE OUTCOMES:

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

CO1:Design applications using stacks and implement various types of queues.
CO2:Analyze and implement operations on linked lists and demonstrate their applications.
CO3:Demonstrate operations on trees.
CO4:Demonstrate implementation of various types of Graphs and Graph Traversals.
CO5:Implement various searching and sorting techniques.

UNIT-I:

Introduction: Definition of data structure, types and overview of data structures.
Algorithm: Preliminaries of algorithm, Algorithm analysis and complexity.
Stacks and Queues: Stack Representation using Arrays, operations on stack, Applications of stacks - Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions. Queue Representation using Arrays, operations on queues, Applications of queues, Circular queues, Priority queues, Implementation of queue using stack.

UNIT-II:

Linked Lists: Introduction, Single linked list, representation of a linked list in memory**,** Operations on a single linked list. Double linked list, Operations on a double linked list. Circular linked list, Operations on a circular linked list. Applications of single linked list.

UNIT-III:

Trees: Basic tree concepts. **Binary Trees:** Properties, Representation of Binary Trees using Arrays and Linked List, Binary Tree Traversals, Creation of binary tree from pre-order, in-order and post order traversals, threaded binary tree. **Binary search trees:** Basic concepts, BST operations: Search, insertion, deletion and traversals, Creation of binary search tree from in-order and pre (post)order traversals.

AVL Trees: Self Balanced Trees, Height of an AVL Trees and AVL Tree Rotations.

UNIT-IV:

Graphs: Basic concepts, Representations of Graphs: using Linked list and adjacency matrix, Graph Traversals - BFS & DFS, Applications: Dijkstra's shortest path algorithm, Minimum Spanning Tree using Prim's algorithm and Kruskal's algorithm, Transitive closure, Warshall's algorithm.

UNIT-V:

Searching: Linear Search, Binary Search and Fibonacci search.
Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Radix sort.

Hashing: Introduction, Hash Function, Collision Resolution Techniques: Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Separate Chaining, Extendible Hashing.

TEXT BOOKS:

1. Richard F. Gilberg and Behrouz.A. Forouzan, Data Structures: A Pseudo code approach with C by 2nd edition, Cengage, 2012.
2. Debasissamanta,Classic Data Structures, PHI, 2nd edition, 2016.
3. Yashavant Kanetker, Data Structures through C, 2nd edition by BPB publications, 2017.
4. Alfred V Aho, John E Hopcraft, Jeffery D Ullman,Data Structures & Algorithms, Pearson Education. Ltd., Second Edition 2016.

REFERENCE BOOKS

1. Seymour Lipschutz, Data Structure with C, , TMH, 2017
2. G. A. V. Pai, Data Structures and Algorithms, , TMH, 2017.
3. Horowitz, Sahani, Anderson Freed, Fundamentals of Data Structure in C, University Press, 2nd edition, 2018.

SEMESTER-III	L	T	P	C
	0	0	3	1.5
19EC3L01: ELECTRONICS CIRCUITS - I LAB				

COURSE OUTCOMES:

After completion of the course students are able to

CO1 : Describe the diode, FET and transistor characteristics (K1)

CO2 : Explaine the rectifier circuits using diodes and implement them using hardware.(K2,K3)

CO3 : Construct various Linear and Non – Linear wave shaping circuits and implement them using hardware, also observe their responses for different input signals(K3)

CO4 : Analize the switching characteristics using Transistor.(K4)

PART A: (Only for viva voce Examination)

ELECTRONIC WORKSHOP PRACTICE (in 2 lab sessions):

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT, and DIP) Bread Boards.
2. Identification, Specifications and Testing of Active Devices, Diodes-(PN diode, Zener, laser, Photo, varactor, tunnel, schottkey) ,BJTs, Low power JFETs,MOSFETs, Power Transistors, LEDs, LCDs, Optoelectronic Devices, SCR, UJT, DIACs, TRIACs.
3. Single layer and Multi-layer PCBs (Design procedure using PCB 123 software).
4. Study and operation of a) Multimeters (Analog and Digital) b) Function Generator c) Regulated Power Supplies d) Study and Operation of CRO.

PART B: (Any ten experiments)

1. PN Junction diode characteristics a) Forward bias b. Reverse bias (cutin voltage & Resistance calculations).
2. Zener diode characteristics.
3. Zener Diode as a regulator.
4. Transistor CB characteristics (Input and Output).
5. Transistor CE characteristics (Input and Output).
6. Half wave Rectifier without and with filter.
7. Full wave Rectifier without and with filter.
8. FET characteristics (Drain and Transfer)

9. Linrst Wave Shaping: RC Low Pass & High Pass Circuits.

10. Clippers using Diodes

11. Clampers.

12. Transistor acts as a Switch.

Equipment Required for Laboratory:

1. Regulated Power supplies (RPS) - 0-30v

2. CROs - 0-20M Hz

3. Function Generators - 0-1 M Hz

4. Multimeters

5. Decade Resistance Boxes/Rheostats

6. Decade Capacitance Boxes

7. Micro Ammeters (Analog or Digital) - 0-20μA, 0-50μA, 0-100μA, 0-200μA

8. Voltmeters (Analog or Digital) - 0-50V, 0-100V, 0-250V

9. Electronic Components - Resistors, Capacitors, BJTs, PN diode, Zener diode, Photo diode, FETs, diodes (Ge & Si Type), transistors (NPN & PNP)

SEMESTER-III	L	T	P	C
	0	0	3	1.5
19EC3L02: DIGITAL ELECTRONICS LAB				

COURSE OUT COMES

After completion of the course students are able to

CO1:Describe and implementation of code conversion(K1)

CO2:Explain simple Boolean expressions using the theorems and to minimize the combinational functions.(K2,K3)

CO3:Analyze combinational circuits like Adders, Subtractors, Encoders, Decoders etc. (K4)

CO4:Construct various types of sequential circuits like Flipflops, counters and Registers (K3)

LIST OF EXPERIMENTS:

Minimum of TEN Experiments has to be performed

1. Design and implementation of code conversion from binary -to-gray.
2. Implementing of logic gates with Universal Gates.
3. Design a logic diagram for the given SOP or POS form and verify the De-Morgan laws.
4. Construct and verify the truth tables of Half Adder, Full Adder using two Half Adders
5. & one OR gate.
6. Design a Combinational Logic circuit for
    a. 4x1 MUX and verify the truth table.
    b. 2 - variable function using 4x1 MUX and verify the truth table.
7. Design a Combinational Logic circuit for 1x4 De- MUX and verify the truth table.
8. Design 4-bit Comparator using IC 7485 and verify the Truth Table.
9. Design 3 to 8 Decoder using IC 74138 and verify the Truth Table.
10. Design Universal Shift Register using IC 74194 and verify the Truth Table.
11. Verify the truth tables of all Flip- Flops.
12. Implementation of Master Slave Flip-Flop with J-K Flip- Flop and verify the truth table.
13. Design a Decade Counter using IC 7490 and verify the truth table.
14. Design the Mod 5 counter using any Flip -Flop.
15. Construct 4-bit ring counter using any Flip –Flop and verify the truth table.
16. Design a 8 – bit Shift right Register using D-Flip -Flop and verify the truth table.

Equipment Required For Laboratory :

1. RPS – 0-30 v
2. IC‘s- 7400, 7402, 7485, 74194, 74138, 7408, 7404, 7432, 7468, 74151, 74153, 7490.
3. Digital logic trainers & bread boards.

SEMESTER-III	L	T	P	C
	0	0	3	1.5
19CS3L01 DATA STRUCTURES LAB				

COURSE OUTCOMES:

At the end of the lab students are able to

1. Illustrate various linked lists and its operations.
2. Complete operations on stack application using arrays and linked lists.
3. State Queue operations and applications using arrays and linked lists.
4. Demonstrate various operations on binary trees.
5. Apply various searching techniques for user data.
6. Apply various sorting techniques for user data.

Note: Students has to complete at least 20 Programs

Write C Program for the following

Exercise – I : Linked Lists

1. Program to create and display a singly linked list.
2. Program to create a singly linked list of n nodes and count the number of nodes
3. Program to create a singly linked list of n nodes and display it in reverse order
4. Program to delete a new node from the beginning of the singly linked list
5. Program to delete a new node from the middle of the singly linked list
6. Program to delete a node from the end of the singly linked list
7. Program to find the maximum and minimum value node from a singly linked list
8. Program to insert a new node at the middle of the singly linked list
9. Program to insert a new node at the beginning of the singly linked list
10. Program to insert a new node at the end of the singly linked list
11. Program to remove duplicate elements from a singly linked list
12. Program to search an element in a singly linked list
13. Program to sort the elements of the singly linked list
14. Program to Search an element in a Linked List (Iterative and Recursive)
15. Program to Nth node from the end of a Linked List

Exercise – II Stacks and Queues

Stacks

16. Program to implement STACK operations using Arrays.
17. Program to implement STACK operations using Linked List.
18. Program to implement STACK operations using QUEUE operations.
19. Program to Reverse the list using STACK operations.
20. Program to convert Infix expression into Postfix expression.
21. Program to evaluate Postfix expression.
22. Program to calculate factorial of a given number using STACK operations.

Queues

23. Program to implement QUEUE operations using Arrays.
24. Program to implement QUEUE operations using Linked List
25. Program to implement QUEUE operations using STACK operations.
26. Program to implement Circular Queues using Arrays.
27. Program to implement Priority Queue using Arrays.

Exercise – III Tress

28. To create a Binary Search Tree of integers, insert, delete and search integers into (from) Binary search tree.
29. Use recursive functions to traverse a binary search tree in preorder, in-order and post-order.
30. Program to Construct a Binary Search Tree and Perform Deletion and In-order Traversal
31. Program to Find the Largest Element in a Binary Tree
32. Program to Find the Smallest Element in a Binary Tree
33. Program to Find the Sum of all the Nodes of a Binary Tree
34. Program to Implement Binary Tree using the Linked List
35. Program to Search a Node in a Binary Tree.

Exercise – IV Searching Techniques

36. Program to search an element in the array using iterative Linear Search.
37. Program to search an element in the array using recursive Linear Search.
38. Program to search an element in the array using iterative Binary Search.
39. Program to search an element in the array using recursive Binary Search.
40. Program to search an element in the array using iterative Fibonacci Search.
41. *Program to search an element in the array using recursive Fibonacci Search*

Exercise – V Sorting Techniques

42. Program to implement Bubble Sort, to sort a given list of integers in ascending order.
43. Program to implement Selection Sort, to sort a given list of integers in ascending order.
44. Program to implement Insertion Sort, to sort a given list of integers in ascending order.

45. Program to implement Quick Sort, to sort a given list of integers in ascending order.
46. Program to implement Quick Sort, to sort a given list of integers in ascending order using recursion method.
47. Program to implement Merge Sort, to sort a given list of integers in ascending order.
48. Program to implement Merge Sort, to sort a given list of integers in ascending order using recursion method.
49. Program to implement Radix Sort, to sort a given list of integers in ascending order.
50. Program to implement Merge Sort., to sort a given list of integers in ascending order.
51. Program to implement Heap Sort, to sort a given list of integers in ascending order.

Exercise – VI Graphs

52. Program to Implementation of Breadth-First Search Techniques.
53. Program to Implementation of Depth- First Search Techniques.
54. Program to Implementation of Prim's Algorithm.
55. Program to Implementation of Dijkstra's Algorithm.
56. Program to Implementation of Kruskal's Algorithm.

Text Books:

1.Yashavant Kanetker,Data Structures Through C 2nd Edition, BPB Publications, 2018

2.Mark Allen Weiss,Data structures and Algorithm Analysis in C, Pearson Education. Ltd., Second Edition 2013.

3.Alfred V Aho, John E Hopcraft, Jeffery D Ullman, Data Structures & Algorithms, Pearson Education. Ltd., Second Edition 2016.

Reference Books:

1.S.Sahni, Fundamentals of Data Structures in C, Second Edition, Universities Press, Pvt. Ltd.

2.R. S. Salari,Data Structures and Algorithms using C by Fifth Edition, KHANNA Publishing.

3.Langsam, Augenstein and Tanenbaum, Data structures using C and C++, PHI.

4.Narasimha Karumanchi, Data Structures and Algorithms Made Easy: Second Edition: Data Structure and Algorithmic Puzzles, Fifth Edition, Career Monk.

5.Reema Thareja, Data Structures Using C, Second Edition, Oxford.

Problem-solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education

SEMESTER-III	L	T	P	C
	2	0	0	0
19CE0M01: ENVIRONMENTAL SCIENCE				

UNIT-I:

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES:

Definition, Scope and Importance –Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects;. Role of information technology in environment and human health.

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem; - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT-II:

NATURAL RESOURCES:

Natural resources and associated problems. Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT-III:

BIODIVERSITY AND ITS CONSERVATION:

Definition: genetic, species and ecosystem diversity-classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

UNIT – IV

ENVIRONMENTAL POLLUTION:

Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his wellbeing.

Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

UNIT – V

SOCIAL ISSUES AND THE ENVIRONMENT:

Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.

Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics.

The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books:

1. K. V. S. G. Murali Krishna , Environmental Studies,VGS Publishers, Vijayawada, 2010
2. R. Rajagopalan, Environmental Studies, 2nd Edition, Oxford University Press, 2011
3. P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani, Environmental Studies, 2nd Edition , Pearson Education, Chennai,2015

Reference:

1. Deeshita Dave & P. Udaya Bhaskar Text Book of Environmental Studies, Cengage Learning, 2011
2. Shaashi Chawla, A Textbook of Environmental Studies, TMH, New Delhi,2017
3. Benny Joseph, Environmental Studies, Tata McGraw Hill Co, New Delhi, 2006
4. Anubha Kaushik, C P Kaushik , Perspectives in Environment Studies, New Age International Publishers, 2014

SEMESTER-IV	L	T	P	C
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19EC4T01: ELECTRONIC CIRCUITS-II				

COURSE OUTCOMES

After completion of the course students are able to

CO1:Describe the frequency response of single stage amplifiers and multistage amplifier using BJTs and FETs in different configurations.(K1)

CO2:Construct Hybrid- π Common Emitter transistor model. Compare and analyze the different types of feedback amplifiers and oscillator circuits.(K3)

CO3:Explain the efficiency of different types of power amplifiers. Analyze Second harmonic distortions, Higher order harmonic Distortion.(K2,K3)

CO4:Analyze the Multivibrators and time base generators.(K4)

UNIT –I:

SMALL SIGNAL LOW FREQUENCY AMPLIFIER MODELS:

BJT: h-Parameters, Hybrid model for transistor (CE, CB& CC configuration), Classification of voltage amplifiers, Derivations for voltage gain, current gain, input resistance & Output resistance of CE, CB& CC amplifiers.

FET: Small signal model, Study of CG,CS and CD amplifiers, Low frequency response of FET amplifier circuits.Comparison of FET amplifiers.

SMALL SIGNAL HIGH FREQUENCY AMPLIFIER MODELS:

BJT:Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid π conductances, Hybrid π capacitances, validity of hybrid πmodel, determination of high-frequency parameters in terms of low- frequency parameters, CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response.

FET: Analysis of common Source and common drain

UNIT –II:

MULTISTAGE AMPLIFIERS:

Classification of amplifiers, methods of coupling, cascadedtransistor amplifier and its analysis, analysis of two stage RC coupled amplifier, high input resistance transistor amplifier circuits and their analysis- Darlington pair amplifier, Cascode amplifier, Boot-strap emitter follower, Analysis of multi stage amplifiers using FET.

UNIT –III:

FEEDBACK AMPLIFIERS AND OSCILLATORS:

Concepts of feedback–Classification of feedback amplifiers – Generalcharacteristics of negative feedback amplifiers –Effectof Feedbackon amplifier characteristics –Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations –problems. Condition for oscillations.RCand LC type Oscillators – Frequency and amplitude stability of oscillators – Generalized analysis of LC oscillators, Quartz, Hartley, and Colpitts Oscillators – RC-phase shift and Wien-bridge oscillators.

UNIT –IV

POWER AMPLIFIERS AND VOLTAGE REGULATORS:

Classification of power amplifier, ClassA Power Amplifier, Maximum Value of Efficiency of Class A Amplifier, Transformer Coupled Amplifier, Push Pull and Complimentary Symmetry Class B and Class AB Power Amplifiers - Principle of operation of class-C Amplifier, Transistor Power Dissipation, Heat Sinks. Voltage regulator, Stabilization factors, Design of Shunt regulator (using Zener diode & BJT), series voltage regulator (using BJT).

UNIT – V

MULTIVIBRATORS AND TIME BASE GENERATORS:

Classification of multivibrators, design of Astable, Monostable, Bistable multivibrator and Schmitt trigger using BJT. Design of triggering circuits for Multivibrators**.**General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators – basic principles.

TEXT BOOKS:

1. J. Millman&C.Halkias -‘Electronic devices & circuits’-IInd Edition- Tata McGraw Hill Publication
2. Allen Mottershed –‘Electronic devices & circuits’-Prentice- Hall India
3. N.C. Goyal& R.K. Khetan-‘ A Monograph on Electronics Design Principles’-Vth Edition- Khanna Publishers
4. J. Milman& H. Taub‘ Pulse Digital & Switching Waveforms - IInd Edition- Tata McGraw Hill Publication

REFERENCES BOOKS:

1. David A. Bell –‘Electronic devices & circuits’- IVth Edition- Prentice- Hall India
2. J Millman & A. Grabel-‘Microelectronics’- II nd Edition- McGraw Hill International Editions

SEMESTER-IV	L	T	P	C
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19EC4T02: ANALOG AND DIGITAL COMMUNICATION				

COURSE OUTCOMES

After completion of the course students are able to

CO1:Illustrate the communication system, need for modulation, AM & FM techniques.(K3)

CO2:Describe the various types of Pulse Modulation techniques.(K1)

CO3:Explain the Information Theory And Coding Techniques(K2,K3)

CO4:Analyze the transmission and reception of a signal in a communication system by using differenttypes of transmitters and receivers.(K4)

UNIT-1

ANALOG MODULATION TECHNIQUES:

Introduction to communication system, Need for modulation, Generation of AM waves: Square law Modulator, Switching modulator, Detection of AM Waves: Square law detector, Envelope detector, Generation of DSBSC Waves: Balanced Modulators, Ring Modulator, Coherent detection of DSB-SC Modulated waves. Generation of SSB-SC Modulated waves: Frequency and Phase discrimination methods. Coherent detection of SSB-SC Modulated waves.

UNIT-II

FREQUENCY MODULATION:

Generation of FM Waves, Indirect or Armstrong FM, Direct FM using Hartley oscillator, Detection of FM Waves: Phase discriminator, Zero crossing detector. **PULSE ANALOG MODULATION:** Type's Analog pulse modulation, PAM (Single polarity, double polarity) Generation & detection, PWM: Generation & detection, PPM: Generation & detection.

UNIT-III

PULSE DIGITAL MODULATION:

Elements of digital communication systems, Pulse Code Modulation (PCM) Generation & detection, Differential PCM systems (DPCM) Generation & detection, Delta modulation (DM) Generation & detection, Adaptive Delta modulation (ADM) Generation & detection.

DIGITAL MODULATION TECHNIQUES: Generation & detection of ASK, FSK, PSK, DPSK, QPSK, M-ary PSK, FSK, QAM, Comparison of all digital modulation techniques.

UNIT-IV

INFORMATION THEORY AND CODING:

Average information(Entropy) and its properties. Information rate, Mutual information and its properties. Channel capacity theorem. Matrix description of Linear Block codes, Error detection and correction capabilities of Linear block codes, single error correcting Hamming codes, Encoding of Convolutional codes, time domain approach, transform domain approach. Graphical approach: code tree, trellis and state diagram, and Viterbi decoding.

UNIT-V

TRANSMITTERS AND RECEIVERS:

TRANSMITTERS - Classification of Transmitters, AMTransmitters, Effect of feedback on performance of AM Transmitter, FM Transmitter – Variable reactance type and phase modulated FM Transmitter, frequency stability in FM Transmitter. **RECEIVERS** - Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver, Intermediate frequency, AGC, FM Receiver and comparison with AM Receiver, Amplitude limiting. Digital FM receivers.ISDN:- Broad band, Narrow Band ISDN.

TEXT BOOKS:

1. George Kennedy and Bernard Davis, Electronic Communication System, TMH, 2004.
2. H Taub. & D. Schilling, GautamSahe, Principles of Communication Systems, 3rd Edition, TMH, 2007.
3. Simon Haykin, John Wiley, Digital communications1st Edition**,**TMH, 2005.

REFERENCES:

1. Simon Haykin, John Wiley, Principles of Communication Systems -, 2nd Edition. TMH
2. K.Sam Shanmugam John Wiley Digital and Analog Communication Systems, 1st Editon, TMH.2005.

SEMESTER-IV	L	T	P	C
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19EC4T03: ELECTROMAGNETIC WAVES AND TRANSMISSION LINES				

COURSE OUTCOMES:

After completion of the course students are able to

CO1. Explain the basics of electrostatic & electromagnetic.(K2,K3)

CO2. Demonstrate Maxwell equations and different postulates of EM fields.(K2)

CO3.Describe the behavior of EM waves propagation in conducting and dielectric media.(K1)

CO4. Analyze the propagation problems of EM waves through transmission lines and its design. (K4)

UNIT –I

ELECTROSTATICS AND MAGNETO STATICS:

ELECTROSTATICS: Coulomb's Law, Electric Field Intensity, Fields due to Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Energy density, Dielectric Constant, Poisson's and Laplace's Equations. **Magneto Statics** : Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Magnetic Scalar and Vector Potentials.

UNIT-II

MAXWELL'S EQUATIONS (STATIC & DYNAMIC FIELDS):

Faraday's Law, continuity equation for time varying fields, conduction and displacement current densities, Inconsistency of Ampere's Law, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Related Problems.

UNIT –III

EM WAVE CHARACTERISTICS - I: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves, Relations between E & H. Wave Propagation in Lossless and Conducting Media. Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Depth of penetration, Polarization, Related Problems.

UNIT- IV

EM WAVE CHARACTERISTICS – II:

Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle, Total Internal Reflection, Poynting Vector and Poynting Theorem and its Applications.

UNIT- V

TRANSMISSION LINES :

Types, Parameters, Transmission Line Equations, Primary & Secondary Constants (Expressions for Characteristic Impedance, Propagation Constant), Infinite Line Concepts, Lossless Characterization, Distortion – Condition for Distortion less and Minimum Attenuation, Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines, Impedance Transformations. Single and Double Stub Matching, Smith chart, Configuration and Applications.

TEXT BOOKS:

1. N.O.Sadiku,, S.V Kulakarni,Principles of Electromagnetics -Matthew Oxford Univ.Press, 6th ed, 2017.
2. E.C.Jorden and K.G.Balmain, Electromagnetic Waves and Radiating Systems - PHI 2nd Edition, 2000.

REFERENCE BOOKS:

1. Y. Mallikarjuna Reddy , Electromagnetic Waves and Transmission Lines –University press (India) Pvt.,Ltd.,2015.
2. John .D. Ryder Networks, Lines and Fields II Edition
3. G. S. N. Raju, Electromagnetic Field Theory and Transmission Lines- Pearson Ed. P te. Ltd., 2005

SEMESTER-IV	L	T	P	C
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19EE4T02: CONTROL SYSTEMS				

COURSE OUTCOMES:

After completion of the course students are able to

CO1:Derive the Transfer Function of Physical Systems and Apply Block Diagram and Signal Flow Graph Techniques for Determining the Transfer Function.

CO2:Analysis a System Using Time Domain and Frequency Domain and Understand the Concepts of Compensators to Improve System Performances.

CO3:Analyze Absolute and Relative Stability of LTI Systems.

CO4:Examine the Concepts of Controllability and Observability.

UNIT-I

MATHEMATICAL MODELING OF CONTROL SYSTEMS

Introduction- Type of Control Systems -Open Loop and Closed Loop, Classification of Control Systems, Feedback Characteristics, and Transfer Function of Linear Systems, Differential Equations of Electrical Networks, Translational and Rotational Mechanical Systems, Block Diagram Reduction Techniques, Representation by Signal Flow Graph – Reduction Using Mason's Gain Formula.

UNIT-II

TIME RESPONSE ANALYSIS

Introduction-Standard Test Signals-Time Response of First Order Systems-Time Response of Second Order Systems-Time Domain Specifications, Steady State Errors and Error Constants, Effects of PI, PD and PID Controllers.

UNIT-III

FREQUENCY RESPONSE ANALYSIS AND COMPENSATION

Introduction-Frequency Domain Specifications- Bode Plot-Polar Plots. Nyquist Stability Criterion. Introduction to compensators, Design of Lag, Lead and Lag-Lead Compensators in frequency domain.

UNIT-IV

STABILITY ANALYSIS

The Concept of Stability- Location of Poles on s-Plane for Stability- Routh's Stability Criterion-Limitations of Routh's Stability, Root Locus.

UNIT-V

STATE SPACE ANALYSIS

Concepts of State, State Variables and State Model - State Space Representation of Transfer Function - State Transitions Matrix and Its Properties - Concept of Controllability and Observability.

TEXT BOOKS:

1. Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2017.
2. Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014
3. Katsuhiko Ogata, "Modern Control Engineering", Pearson, 2015.

REFERENCE BOOKS:

1. Richard C. Dorf and Bishop, R.H., "Modern Control Systems", Pearson Education,2009.
2. John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, "Linear Control SystemAnalysis and Design with MATLAB", CRC Taylor& Francis Reprint 2009.
3. Rames C.Panda and T. Thyagarajan, "An Introduction to Process Modelling Identification and Control of Engineers", Narosa Publishing House, 2017.
4. M.Gopal, "Control System: Principle and design", McGraw Hill Education, 2012.
5. NPTEL Video Lecture Notes on "Control Engineering" by Prof. S. D. Agashe, IIT Bombay.

SEMESTER-IV	L	T	P	C
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19EE4T04: ELECTRICAL ENGINEERING				

COURSE OUTCOMES:

After completion of the course students are able to

CO1 : Realize the Electrical Equivalent Network for a Given Network Transfer Function.

CO2 : Demonstrate the Construction, Working Principle and Operational Characteristics of DC Machines

CO3 : Explain the Construction and Working Principle of Single Phase Transformer

CO4 : Understand about Three Phase AC System and Demonstrate the Construction, Working Principle and Operational Characteristics of Three Phase Induction Motors

CO5 : Understand the Working Principle of Synchronous and Special Machines

UNIT-I NETWORK SYNTHESIS

Positive Real Function - Basic Synthesis Procedure – LC Immittance Functions - RC Impedance Functions and RL Admittance Function - RL Impedance Function and RC Admittance Function - Foster and Cauer Methods

UNIT-II : DC MACHINES

Introduction-Construction Details -Principle of Operation – EMF Equation – Classification based on Excitation - Torque Equation- Characteristics-OCC of Generator-Load Characteristics of DC Machine, Types of Starters – Speed Control Methods of DC Motors – Swinburne's Test - Applications -Simple Problems.

UNIT-III : TRANSFORMERS

Introduction-Constructional Details - Principle of Operation - EMF Equation – Phasor Diagram on no-Load and Load - Equivalent Circuit, OC and SC Test-Load Test-Voltage Regulation, Losses and Efficiency, Auto Transformer and Three-Phase Transformer Connections.

UNIT-IV : THREE PHASE AC SYSTEMS AND INDUCTION MOTOR

Introduction – Star/Delta Connection – Voltage and Current Relationship- Power in Three Phase Systems- Measurement of Power in Three Phase Systems

Introduction - Construction Details and Principle of Operation of Three-Phase Induction Motors – Types – Slip-Torque Characteristics – Efficiency – Star/Delta Starter.

UNIT-V : SYNCHRONOUS AND SPECIAL MACHINES

Introduction- Construction Details and Principle of Operation of Synchronous Generator -Voltage Regulation- EMF Equation -Principle of Operation of Synchronous Motor - Methods of Starting. Introduction- Principle of Operation and Construction – Reluctance Motor- Hysteresis Motor- Stepper Motor- Brushless DC Motor.

TEXT BOOKS:

1. "Principles of Electrical Engineering and Electronics", V K Mehta & Rohit Mehta,S Chand Publishers,2019 edition.
2. P.S.Bimbra "Electrical Machinery" Khanna Publicaions,7th edition 2019.
3. J.B.Gupta, "Theory and performance of electrical machines"S.K.Katarina Publishers 2015 edition.

REFERENCE BOOKS:

1. Rajendhra Prasad, "Fundamentals of Electrical Engineering" PHI publishers,3rd edition 2014.
2. Nagsarkar, "Basic Electrical Engineering" PHI publishers3rd edition 2014.

SEMESTER-IV	L	T	P	C
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19EC4L01: ELECTRONICS CIRCUITS-II LAB				

COURSE OUTCOMES

After completion of the course students are able to

CO1:Design the single stage and multistage amplifier using BJTs and FETs.

CO2:Differentiate different types of feedback amplifiers, calculate the input resistance and output resistance of feedback amplifiers.

CO3:Generate the wave forms of oscillator with different frequencies. Obtain the efficiency of the single stage power amplifiers.

CO4:Construct and analyze the characteristics of Series Voltage Regulator and Shunt Voltage Regulator.

PART A:

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. Single Stage CE Amplifier
2. Single Stage CC Amplifier
3. Two Stage RC Coupled Amplifier
4. Current- Series Feedback amplifier
5. Voltage Shunt Feedback amplifier
6. RC Phase Shift/Wien Bridge Oscillator
7. Hartley/Colpitt's Oscillator
8. Class A Series-fed Power Amplifier
9. Class B Push-Pull Power Amplifier
10. Shunt Voltage Regulator
11. Series Voltage Regulator
12. Astable multivibrators
13. Mono-stable multivibrator
14. Bi-stable multivibrator
15. Schmitt –trigger using BJT

Note: The students are required to design the electronic circuit and they have to perform the simulationusing Multisim/Pspice/Equivalent Licensed simulation software tool. Further they are required to verify the result using necessary hardware in the hardware laboratory.

PART B: Equipment required for Laboratory

Software:

1. Multisim/ Pspice/Equivalent Licensed simulation software tool.
2. Computer Systems with required specifications.

Hardware:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters and Voltmeters (Analog or Digital)
8. Active & Passive Electronic Components

SEMESTER-IV	L	T	P	C
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19EC4L02: ANALOG AND DIGITAL COMMUNICATION LAB				

COURSE OUT COMES

After completion of the course students are able to

CO1:Explain and analyze different analog and digital modulation techniques.(K2,K3)

CO2:Demonstrate various modulation and demodulation devices.(K3)

CO3:Analyze the various types of modulated signals.(K4)

CO4:Describe digital data encoding and decoding techniques.(K1)

LIST OF EXPERIMENTS

1. Amplitude Modulation and Demodulation.
2. AM - DSBSC Modulation and Demodulation.
3. Spectrum Analysis of Modulated signal using Spectrum Analyzer.
4. Diode detector Characteristics.
5. Frequency Modulation and Demodulation.
6. Pulse Amplitude Modulation and Demodulation.
7. Pulse Width Modulation and Demodulation.
8. To study the Pulse Code Modulation and to compare practical and theoretical values
9. To perform Differential Pulse Code Modulation & demodulation and to plot the waveforms.
10. To perform Delta Modulation and Demodulation
11. To perform ASK Modulation and Demodulation.
12. To perform FSK Modulation and Demodulation.
13. Study of Linear block code Encoder and Decoder
14. Study of Convolution code Encoder and Decoder

Equipment Required for Laboratories:

1. RPS -0 –30 V.
2. CRO -0 –20 M Hz.
3. Function Generators -0 – 1 M Hz.
4. RF Generators -0 – 1000 M Hz. /0 – 100 M Hz.
5. Multimeters.
6. Lab Experimental kits for Analog Communication and Digital Communication.
7. Components.
8. Spectrum Analyzer -60 M Hz.

SEMESTER-IV	L	T	P	C
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19CS4L03: PYTHON PROGRAMMING LAB				

COURSE OUTCOMES:

At the end of the course students are able to

CO1: Apply core programming basics and program design with functions using Python K4
CO2: programming language. K3
CO3: Interpret the high-performance programs designed to strengthen the practical expertise. K3
CO4: Develop applications for real time problems by applying python data structure K4
CO5: concepts. K4
CO6: Test and apply the concepts of packages, handling, multithreading and socket programming. K3

Divide the importance of object oriented programming over structured programming.
Design user interface using case study for application development.

Exercise 1 - Basics

a) Running instructions in Interactive interpreter and a Python Script
b) Write a program to purposefully raise Indentation Error and Correct it

Exercise 2 - Operations

a) Write a program to compute distance between two points taking input from the user(Pythagorean Theorem)
b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

Exercise - 3 Control Flow

a) Write a Program for checking whether the given number is a even number or not.
b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . .1/10
c) Write a program using a for loop that loops over a sequence. What is sequence?
d) Write a program using a while loop that asks the user for a number, and prints a countdownfrom that number to zero.

Exercise 4 - Control Flow - Continued

a) Find the sum of all the primes below two million. Each new term in the Fibonacci sequence is generated by adding the previous two terms. Bystarting with 1 and 2, the first 10 terms will be:
1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...
b) By considering the terms in the Fibonacci sequence whose values do not exceed four million,find the sum of the even-valued terms.

Exercise - 5 - DS

a) Write a program to count the numbers of characters in the string and store them in adictionary data structure
b) Write a program to use split and join methods in the string and trace a birthday with adictionary data structure.

Exercise - 6 DS - Continued

a) Write a program combinelists that combines these lists into a dictionary.
b) Write a program to count frequency of characters in a given file. Can you use characterfrequency to tell whether the given file is a Python program file, C program file or a text file?

Exercise - 7 Files
a) Write a program to print each line of a file in reverse order.
b) Write a program to compute the number of characters, words and lines in a file.

Exercise - 8 Functions
a) Write a function ball_collide that takes two balls as parameters and computes if they arecolliding. Your function should return a Boolean representing whether or not the balls arecolliding.
Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius
If (distance between two balls centers) <= (sum of their radii) then (they are colliding)
b) Find mean, median, mode for the given set of numbers in a list.

Exercise - 9 Functions - Continued
a) Write a function nearly equal to test whether two strings are nearly equal. Two strings a and bare nearly equal when a can be generated by a single mutation on b.
b) Write a function dups to find all duplicates in the list.
c) Write a function unique to find all the unique elements of a list.

Exercise - 10 - Functions - Problem Solving
a) Write a function cumulative product to compute cumulative product of a list of numbers.
b) Write a function reverse to reverse a list. Without using the reverse function.
c) Write function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.

Exercise 11 - Multi-D Lists
a) Write a program that defines a matrix and prints
b) Write a program to perform addition of two square matrices
c) Write a program to perform multiplication of two square matrices

Exercise - 12 - Modules
a) Install packages requests, flask and explore them. using (pip)
b) Write a script that imports requests and fetch content from the page. Eg. (Wiki)
c) Write a simple script that serves a simple HTTPResponse and a simple HTML Page

Exercise - 13 OOP
a) Class variables and instance variable and illustration of the self-variable
i) Robot
ii) ATM Machine

SEMESTER-IV	L	T	P	C
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19BM0M01: PROFESSIONAL ETHICS &INTELLECTUAL PROPERTY RIGHTS				

COURSE OUTCOMES:

Students are able to

CO1. Identify the professional roles played by an engineer and illustrate the process of Social experimentation

CO2.Determine Engineer's responsibilities and rights towards the society

CO3.Analyze various aspects of Intellectual Property Rights and recognize the process of protecting the copyrights

CO4.Describe the registration process of Patents and trademarks and also demonstrate the concept of trade secrets and cybercrimes

UNIT-I

ENGINEERING ETHICS:

Importance of Engineering Ethics-–Professional and Professionalism –Professional Roles to be played by an Engineer –Professional Ethics.

UNIT-II

ENGINEERING AS SOCIAL EXPERIMENTATION :

Role of engineering in knowledge society- Knowledge acquired – Conscientiousness – Relevant Information –Engineers as Managers, Consultants, and Leaders.

ENGINEERS' RESPONSIBILITY FOR SAFETY AND RISK: Role and importance of Safety and risk-Types of Risks –Threshold Levels for Risk– RiskBenefit Analysis.

UNIT-III

ENGINEERS' RESPONSIBILITIES AND RIGHTS:

Collegiality-Conflict of Interest-solving conflict problems – Ethical egoism-Collective bargaining - Confidentiality-Acceptance of Bribes/Gifts--Occupational Crimes-industrial espionage-Whistle Blowing-types of whistle blowing.

UNIT IV

INTELLECTUAL PROPERTY AND COPY RIGHTS:

Introduction to Intellectual Property Law - Types ofIntellectual Property – Infringement,Copyrights**:**Introduction to Copyrights – Principles of Copyright – Rights Afforded byCopyright Law –Copyright Formalities and Registration.

UNIT-V

PATENTS AND TRADEMARKS:

Introduction to Patent Law –Rights under Patent Law – Patent Requirements – Patent Application Process and Granting of Patent – Double Patenting – Patent Cooperation Treaty**.** Trademarks:Introduction to Trade Mark – Trade Mark Registration Process – Trade Markmaintenance – Likelihood of confusion

UNIT-VI

TRADE SECRETS AND CYBER LAW:

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security –Unfair Competition –Breach of Contract .Cyber law**:**Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Data Security .

TEXT BOOKS:

1. M.Govindarajan, S.Natarajan and V.S.SenthilKumar- "Engineering Ethics and Human Values" by PHI Learning Pvt. Ltd-2009.
2. Deborah E.Bouchoux, "Intellectual Property". Cengagelearning , NewDelhi, BS Publications (Press)
3. PrabhuddhaGanguli,' Intellectual Property Rights" Tata Mc-Graw – Hill, New Delhi

SEMESTER-V	L	T	P	C
	3	-	-	3
19EC5T01: LINEAR AND DIGITAL IC APPLICATIONS				

COURSE OUTCOMES:

Upon completing this course, the student will be able to
CO1: Demonstrate different applications based on operational amplifier.
CO2: Explain the applications of waveform generators based on operational amplifier and IC
CO3: Design and implementation of Combinational circuits using digital ICs.
CO4: Design and implementation of Sequential circuits using digital ICs.

UNIT I

INTEGRATED CIRCUITS:

Integrated circuits-Types, Classification, Package Types and temperature ranges, Differential Amplifier- DC and AC analysis of Dual input balanced output Configuration, Properties of other differential amplifier configuration (Dual Input Unbalanced Output, Single Ended Input – Balanced/ Unbalanced Output), DC Coupling and Cascade Differential Amplifier Stages, Level translator.

UNIT II

OPERATIONAL AMPLIFIER AND ITS APPLICATIONS:

Characteristics of OP-Amps, Op-amp Block Diagram, ideal and practical Op-amp specifications.
Op-Amp parameters,(DC and AC characteristics) 741 op-amp & its features. Input & Output offset currents and voltages, slew rate, CMRR, PSRR. Linear Applications of Op-Amps: Inverting and Non-inverting amplifier, Integrator and differentiator, Summing and Difference amplifier, Non-Linear Applications of Op-Amps: Comparators, Triangular and Square wave generators. Sine wave generation: principle, Wein-bridge, phase-shift oscillators.

UNIT-III

ACTIVE FILTERS AND TIMERS:

Introduction, classification, Butter worth filters – 1st order, LPF, HPF, Band pass, Band reject and all pass filters qualitative and quantitative analysis. Timers**:** Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger.Phase Locked Loop(PLL565), Voltage Controlled Oscillator (IC566).

UNIT-IV

COMBINATIONAL LOGIC DESIGN:

Introduction, Design and Analysis procedures, Decoders, encoders, multiplexers and demultiplexer, comparators, Ripple Adder, Binary Parallel Adder, Look ahead carry generator, Binary Adder-Subtractor, ALU, Combinational multipliers, Design considerations of the above combinational logic circuits with relevant Digital ICs.

UNIT-V

SEQUENTIAL LOGIC DESIGN:

SSI latches and flip-flops, Design of Counters using Digital ICs, Counter applications, Synchronous design methodology, Universal Shift Register, Ring Counter, Johnson Counter, Design considerations of the above sequential logic circuits with relevant Digital ICs.

TEXTBOOKS:

1. D. Roy Chowdary, "Linear Integrated Circuits", 2nd Edition, New Age International (p) Ltd,2003.(**Unit-I, II, III)**
2. John F. Wakerly, "Digital Design Principles & Practices", 3rd Edition, PHI/ Pearson Education Asia, 2005 (**Unit-IV, V)**

REFERENCES:

1. Sergio Franco, "Design with Operational Amplifiers & Analog Integrated Circuits", McGraw Hill, 1988.
2. Floyd and Jain, "Digital fundamentals",8th Edition, Pearson education, 2005.

E-REFERENCES:

1. https://lecturenotes.in/subject/449/linear-and-digital-ic-application-ica
2. https://nptel.ac.in/courses/108/108/108108111/

SEMESTER-V	L	T	P	C
	3	1	-	3
19EC5T02: MICROPROCESSOR AND MICRO CONTROLLER				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Explain architecture, instructions and addressing modes of 8086Microprocessor.
CO2: Develop Assembly programs for various industrial requirements.
CO3: Analyze 8086 interfacing with different peripherals and implement programs.
CO4: Design a minimum workable system with 8051Microcontroller.

UNIT-I
8086 MICROPROCESSOR
Introduction to Microprocessors: Little Endian and Big Endian Formats, Von-Neumann and Harvard architectures, RISC Vs CISC processors, Family of Intel processors.
8086 Microprocessor: Register organization, Architecture and Signal description, Physical memory organization, General bus operation, I/O addressing capability, Special purpose activities.

UNIT-II
8086 PROGRAMMING:
Minimum mode and maximum mode configuration, Timing diagrams, program development steps, Addressing modes of 8086, Instruction set of 8086, Assembler directives, writing simple programs with an assembler, Procedures and Macros.

UNIT-III
BASIC PERIPHERALS AND INTERFACING WITH 8086:
Semiconductor memory interfacing, Programmable PeripheralInterface-8255,modes of operation of 8255, Interfacing to D/A and A/D converters, Stepper motor interfacing, Control of high power devices using 8255.

UNIT-IV
SPECIAL PURPOSE PROGRAMMABLE INTERFACING DEVICES:
Interrupts and interrupt service routines, Interrupt cycle of 8086, non-maskable interrupt, maskable interrupts, interrupt programming, Programmable interrupt controller 8259A, programmable communication interface 8251, USART, DMA Controller 8257.

UNIT-V
8051 MICROCONTROLLER:
Introduction to microcontrollers, 8051 microcontroller, 8051 pin description, connections, I/O ports, Memory organization, Instruction set, Interrupts, Timers, Serial port, Programming with Embedded C.

TEXT BOOKS:

1. A .K .Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd Edition, Tata McGraw Hill Publishers, 2012. **(UNITS I -V)**
2. Kenneth Ayala, "8051 Microcontroller", 3rd Edition, Cengage Learning Publishers, 2007. **(UNIT - V)**

REFERENCES:

1. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, and Pentium processors. Architecture, programming and interfacing", 8th Edition, Pearson Publication, 2012.
2. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", 2nd Edition, TMH,2012.
3. Ajay V Deshmukh, "Microcontrollers", 3rd Edition, TATA McGraw Hill publications, 2012.

E-REFERENCES:

1. Microprocessors and Microcontrollers
   https://www.tutorialspoint.com/microprocessor/index.htm

2. Microprocessors and Microcontrollers, NPTEL
   https://nptel.ac.in/courses/108/105/108105102/

SEMESTER-V	L	T	P	C
	3	-	-	3
19EC5T03: ANTENNAS & WAVE PROPAGATION				

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Describe different types of antenna parameters.
CO2: Solve the fields radiated by various types of antennas.
CO3: Explain various categories of antennas and antenna arrays.
CO4: Analyze and identify the characteristics of radio wave propagation.

UNIT-I

ANTENNA FUNDAMENTALS:

Introduction, Radiation Mechanism – single wire, 2 wire, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height.

UNIT-II

THIN LINEAR WIRE ANTENNAS:

Retarded Potentials, Radiation from Small Electric Dipole and Half wave Dipole, Evaluation of Field Components: Power Radiated, Radiation Resistance, Beam widths, Directivity, Effective Area and Effective Height. Antenna Theorems – Reciprocity and Maximum power transfer theorems, Loop Antennas: Small Loops - Directivity and radiation resistance for small loops.

UNIT-III

ANTENNA ARRAYS :

Two element arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison; Concept of Scanning Arrays. Binomial Arrays. Arrays with Parasitic Elements, Yagi - Uda Arrays, Folded Dipoles & their characteristics.

UNIT-IV

NON-RESONANT AND MICROWAVE RADIATORS:

Introduction, Travelling wave radiators – basic concepts, Long wire antennas– field strength calculations and patterns**,** Microstrip antenna (Rectangular patch antenna): introduction, Geometry, features, advantages, limitations and different feeds. Helical Antenna –Geometry, basic properties and operational modes (axial & normal modes). Reflector Antennas: Flat Sheet, Corner Reflectors and Paraboloidal Reflectors.

UNIT-V

WAVE PROPAGATION:

Concepts of Propagation – frequency ranges and types of propagations. Ground Wave Propagation– Characteristics, wave tilt. Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF & Skip Distance – Calculations for flat and spherical earth cases. Space Wave Propagation – Mechanism, LOS and Radio Horizon, Field Strength, Fundamental Equation for Free-Space Propagation, Duct Propagation.

TEXT BOOKS:

1. John D.Kraus and Ronald J.Marhefka Ahmad S Khan, "Antennas and wave propagation", 5 th edition, McGraw Hill Education private limited, 2018. (UNIT-1,2 & 3)
2. K.D.Prasad, Satya Prakashan, " Antennas and wave propagation", 4th edition ,Tech India Publications, New Delhi,2005 (UNIT-1,2,3,4 & 5)

REFERENCES :

1. G.S.N.Raju, "Antennas and wave propagation ", 5th edition,Pearson Education, South Asia 2007.
2. E.C.Jordan and K.G.Balmain , "Electromagnetic Waves and Radiating systems", 5TH Edition, PHI publisher, 2004.

E-REFERENCES

1. Antenna Arrays
   www.nrao.edu (https://public.nrao.edu/telescopes/vla/)
2. *Analysis and design Principles of Microwave Antennas NPTEL IIT Kharagpur*
   https://nptel.ac.in/courses/108/105/108105114/
3. Antennas
   https://onlinecourses.nptel.ac.in/noc20ee20/preview

SEMESTER-V	L	T	P	C
	-	-	3	1.5
19EC5L01: LINEAR AND DIGITAL IC APPLICATIONS LABORATORY				

COURSE OUTCOMES:

Upon completing this course, the students will be able to
CO1: Illustrate various linear circuits using operational amplifiers.
CO2: Demonstrate various combinational circuits and Sequential Circuits using Digital IC's.
CO3: Describe and Implement different Circuits with different IC's.
CO4: Research their knowledge on analog circuits & digital circuits.

Minimum Ten Experiments to be conducted (7 from Part-A & 3 from Part-B)

PART (A)

1. Verify the operation of op – amp as an adder, subtractor and Comparator.
2. Differentiate the operation of op – amp as an Integrator and Differentiator using IC 741.
3. Realize an op – amp as first order Butterworth low pass and high pass filters For a given cut off frequency and verify the frequency response characteristics.
4. Design and realize an op – amp based first order Butterworth band pass filter for a given cut off Frequency and verify the frequency response characteristics.
5. Infer how IC 741 op – amp can be used as RC phase shift oscillator for a desired Frequency
6. Construct and setup astable multivibrator using Op-amp 741 and Plot the waveforms
7. Design set up voltage controlled oscillator using IC566 and plot the waveforms
8.Implement a low voltage regulator using IC723 and plot the regulation characteristics
9. Design and construct a Wien bridge oscillator using Op-Amp 741 and (i) Plot the output waveform (ii) Measure the frequency of oscillation

PART (B)

10. Construct XOR/XNOR gates with universal gates.
11. Examine the operation of IC-74151 as 8X1 line Multiplexer.
12. Develop half subtractor & Full subtractor using logic gates.
13. Implement 4-bit carry look ahead adder using Logic Gates
14.ConstructBCD Counter Circuit using the 74LS90 Decade Counter
15.Design D-Flipfop and T-Flipfops using JK-flipflop

SEMESTER-V	L	T	P	C
	-	-	3	1.5
19EC5L02: MICROPROCESSOR AND MICROCONTROLLER LAB				

COURSE OUTCOMES:

After completion of the course, students are able to
CO1: Write assembly language programs for various problems.
CO2: Design minimum workable system using Microcontroller 8051.
CO3: Interface different external devices like keyboard, DAC, ADC, Stepper motor.
CO4: Develop the Embedded C programs for simple applications.

PART-I: MICROPROCESSOR-8086 PROGRAMMING

1. Verify Arithmetic Operations for Multi byte Addition and Subtraction using ALP.
2. Execute ALP for Multiplication and Division for signed and unsigned Arithmetic operations.
3. Develop assembly programs for different ASCII Arithmetic operation.
4. Explain how Logical operations are performed in Microprocessors with the help of TASM Software.
5. Conversion between BCD and ASCII numbers.
6. Develop different programs for checking all String operations.
7. Apply DOS/BIOS to access various system resources for Reading data from keyboard.
8. Execute Sum of squares/cubes of a given n-numbers.
9. Factorial of given numbers.
10. Perform sorting and searching operations**.**

PART-II: INTERFACING WITH 8086

JJJ. Design an Interfacing circuit for DAC with 8086 µP to generate various waveforms using 8255.
KKK. Write a control word format for 8255 to interface stepper motor with 8086 µP using 8255.
LLL. Keyboard and Display Interface through Intel 8279.
MMM. A/D Interface through Intel 8255

PART-III: INTERFACING WITH 8051 MICROCONTROLLER

1. Write an Embedded C program to interface switches and LEDs/Seven Segment display.
2. Demonstrate different modes of Timers in 8051 µC.
3. Verify how Serial Communication Implemented in 8051 µC.
4. Write an ALP to find addition of even numbers from a given array using 8051.
5. Find average of n-numbers using 8051.
6. Design a Traffic Light Controller.

EQUIPMENT REQUIRED FOR LABORATORY

1. MASM/TASM software
2. 8086 Microprocessor Kits
3. D/A Interface
4. A/D Interface
5. Stepper motor
6. 8051 Micro Controller kits
7. Keil Software

SEMESTER-V	L	T	P	C
	-	-	4	2
19CS5L04: JAVA PROGRAMMING LAB				

Course Outcomes:

At the end of the lab student are able to

1. Implement solutions for a range of problems using object-oriented programming.
2. Develop Java programs that solve simple business applications.
3. Develop Java programs using String and StringBuffer Class
4. Develop Java programs that implement concept of various types of inheritance.
5. Implement Java programs using packages and interfaces.
6. Implement Exception Handling in java.

Note: Use JDK 1.7 or above on any platform.

LAB EXPERIMENTS

1. Installation of JDK, setting CLASSPATH and executing simple java program.
2. Write a Java Program to define a class, describe its constructor, overload the Constructors and instantiate its object.
3. Write a Java Program to define a class, define instance methods for setting and retrieving values of instance variables and instantiate its object.
4. Write a Java Program to define a class, define instance methods and overload them and use them for dynamic method invocation.
5. Write a Java Program to demonstrate use of sub class.
6. Write a Java Program to implement array of objects.
7. Write a Java program to practice using String class and its methods.
8. Write a Java program to practice using String Buffer class and its methods.
9. Write a Java Program to implement inheritance and demonstrate use of method overriding.
10. Write a Java Program to implement multilevel inheritance by applying various access controls to its data members and methods.
11. Write a program to demonstrate use of implementing interfaces.
12. Write a Java program to implement the concept of importing classes from user defined package and creating packages.
13. Write a program to implement the concept of Exception Handling using predefined exception.
14. Write a program to implement the concept of Exception Handling by creating user defined exceptions.

Text Books

1. Herbert Schildt: “Java The complete reference”, 7th Edition, Tata McGraw Hill, 2011.
2. E.Balaguruswamy: “Programming with Java A Primer”, 4th Edition, Tata McGraw Hill, 2009.

SEMESTER-V	L	T	P	C
	2	-	-	-
19BM0M02: INTRODUCTION TO CYBER LAW				

UNIT I: Introduction Computers and its Impact in Society-Overview of Computer and Web Technology-Need for Cyber Law-Cyber Jurisprudence at International and Indian Level.

UNIT II: Cyber Law - International Perspectives UN & International Telecommunication Union (ITU) Initiatives Council of Europe - Budapest Convention on Cybercrime- Asia Pacific Economic Cooperation (APEC) -Organization for Economic Co-operation and Development (OECD) -World Bank-Commonwealth of Nations.

UNIT III: Constitutional & Human Rights- Issues in Cyberspace -Freedom of Speech and Expression in Cyberspace- Right to Access Cyberspace – Access to Internet- Right to Privacy-Right to Data Protection

UNIT-IV: Cyber Crimes & Legal Framework-Cyber Crimes against Individuals, Institutions and State-Hacking- Digital Forgery- Cyber Stalking/Harassment- Cyber Pornography- Identity Theft & Fraud-Cyber terrorism-Cyber Defamation-Different offences under IT Act, 2000.

UNIT V: Cyber Torts-Cyber Defamation-Different Types of Civil Wrongs under the IT Act, 2000-Intellectual Property Issues in Cyber Space Interface with Copyright Law- Interface with Patent Law-Trademarks & Domain Names Related issues

TEXTBOOKS:

1. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
2. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012).
3. JonthanRosenoer, Cyber Law, Springer, New York, (1997).

REFERENCE BOOKS:

1. SudhirNaib, The Information Technology Act, 2005: A Handbook, OUP, New York, (2011)
2. S. R. Bhansali, Information Technology Act, 2000, University Book House Pvt. Ltd., Jaipur (2003).
3. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi, (2003).
4. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)

ELECTIVE-I	L	T	P	C
	3	-	-	3
19EC5E01 : NANO TECHNOLOGY				

COURSE OUTCOMES:

Students are able to

CO1. Define Nano materials and Nano Technology with properties

CO2. Explain Synthesis as Fabrication methods of Nano Technology

CO3. Demonstrate Characterization techniques of Nano Materials

CO4. Analyze carbon Nano technology and application of Nano technology.

UNIT-I

INTRODUCTION: History of nano science, definition of nano meter, nano materials, nano technology, Classification of nano materials, Applications in material science, biology and medicine, surface science, energy and environment, Crystal symmetries, crystal directions, crystal planes, Band structure,

UNIT-II

PROPERTIES OF MATERIALS: Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

UNIT-III

SYNTHESIS & FABRICATIONMETHODS: Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography.

UNIT-IV

CHARECTERIZATION TECHNIQUES: X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy.

UNIT-V

CARBON NANO TECHNOLOGY: Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nanocrystalling diamond films, grapheme, applications of carbon nanotubes, carbon nanotubes for nanoelectronics devices.

TEXT BOOKS:

1.Nano science and nano technology by M.S RamachandraRao, Shubra Singh, Wiley publishers. **(UNITS-I,II&III)**

2.Fundamentals of nano electronics by George W Hanson Pearson publications, India 2008 **(Unit- I, IV&V)**

REFERENCE BOOKS:

1.Introduction to Nano Technology by Charles P. Poole, Jr., Frank J.Owens, Wiley publishers.

2.Principles of Nanotechnology by Phani Kumar, Scitech.

ELECTIVE-I	L	T	P	C
	3	-	-	3
19EC5E02 : INFORMATION THEORY AND CODING				

COURSE OUTCOMES:

Upon completing this course, the student will be able to

CO1: Explain what is the significance of this quantitative measure of information in the communications systems

CO2: Obtain knowledge in designing various source codes and channel codes

CO3: Design encoders and decoders for block and cyclic codes

CO4: Understand the significance of codes in various applications

UNIT I

INFORMATION THEORY :

Introduction, Types of Information sources, Discrete messages, Concept of amount of information and its properties, Average information, Entropy and its properties, Information rate, Mutual information and its properties,

UNIT II

CHANNEL CAPACITY & SOURCE CODING :

Shannon-Hartley Theorem, Channel capacity of analog and discrete Channels, Capacity of a Gaussian channels, bandwidth – S/N trade off, Introduction to source coding, Shannon's source coding theorem, Shanon-Fano coding, Huffman coding.

UNIT-III

LINEAR BLOCK CODES :

Introduction to channel coding, Classification of channel coding techniques-Error detection and correction codes, Systematic and Non-systematic codes, Matrix description of Linear Block codes, Encoding using Generator Matrix, Syndrome Calculation, Decoding of linear block codes.

UNIT-IV

BINARY CYCLIC CODES:

Introduction, Polynomial Representation of Code words, Generator Polynomial, Systematic cyclic codes, Encoder design, Syndrome Calculation, Error Detection, Decoder design, and Limitations of Cyclic Codes.

UNIT-V

CONVOLUTIONAL CODES:

Encoding and State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes - Viterbi algorithm, Sequential decoding -Stack algorithm. Interleaving techniques –Block and convolutional interleaving.

TEXTBOOKS:

1. T. M. Cover, J. A. Thomas, "Elements of Information Theory", 2nd Edition, John Wiley & Sons Inc publication, 2005. (UNIT I-V)

REFERENCES:

1. R. Togneri, C.J.S deSilva, "Fundamentals of Information Theory and Coding Design",1st edition, Taylor and Francis, 2003.
2. R. J. McEliece, "The Theory of Information and Coding", 2nd edition, Cambridge University Press, 2012.
3. R. Bose, Information Theory Coding and Cryptography, 2nd edition, Tata McGraw Hill, 2002.

E-REFERENCES:

1. https://www.tutorialspoint.com/principles_of_communication/principles_of_communication_information_theory.htm
2. https://kanchiuniv.ac.in/coursematerials/Information_coding_theory.pdf
3. https://en.wikipedia.org/wiki/Information_theory
4. https://www.cl.cam.ac.uk/teaching/0809/InfoTheory/InfoTheoryLectures.pdf

ELECTIVE-I	L	T	P	C
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19CS5E18: COMPUTER SYSTEM ARCHITECTURE				

Course Outcomes:

At the end of the course students are able to

1. Identify various types of computer Architectures
2. Classify different instruction set architectures
3. Differentiate multiprocessor architecture from multi computers.
4. Analyze shared memory architectures and multithreading techniques
5. Explain parallel computer systems with ILP concepts.
6. Explain the several advanced optimization to achieve cache performance

UNIT-1

Parallel Computer Models: The state of computing-Multiprocessors and Multi computers- Multivector and SIMD Computers.

Program and Networks Properties: Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures.

UNIT-2

Processors and memory hierarchy: Design space of processors, Instruction set Architectures, Characteristics of typical CISC and RISC Architecture, Hierarchical Memory Technology, Inclusion, Coherence and Locality.

Cache memory organizations: cache addressing modes, direct mapping and Associative Caches, set-Associative and sector caches, cache performance issues

UNIT-3

Multiprocessors and Multicomputer: Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputer, Message-Passing Mechanisms.

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessors, Compound Vector Processing, SIMD Computer Organizations, The Connection Machine CM-5.

UNIT-4

Scalable, Multithreaded, and Dataflow Architectures: Latency, Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures, Dataflow and Hybrid Architectures.

UNIT -5

Instruction Level Parallelism: Introduction, Basic Design Issues, Problem Definition, Model of a Typical Processor, Operand Forwarding, Reorder Buffer, Register Renaming-Tomasulo‘s. Algorithm, Branch Prediction, Limitations in Exploiting Instruction Level Parallelism, Thread Level Parallelism.

TEXT BOOKS:

1. Advanced Computer Architecture- by Kai Hwang and Jotwani, Second Edition, McGraw-Hill Publications.

REFERENCES:

1. Computer Architecture and Parallel Processing by Hwang and Briggs
2. Computer Architecture A quantitative approach Third Edition John L.Hennessy and David A. Patterson, Morgan Kufmann (An Imprint of Elsevier).

ELECTIVE-I	L	T	P	C
	3	-	-	3
19EC5E03:TRANSFORM TECHNIQUES				

COURSE OUTCOMES:

Upon completing this course, the students will be able to
CO1: To learn basics of two dimensional transform.
CO2: Understand the various two dimensional transform definition, properties and applications.
CO3: Understand the design of filter Bank structure.
CO4: To learn the fundamentals of wavelet transform and special wavelets.

UNIT I
TRANSFORMS:
Walsh, Hadamard, Haar and Slant Transforms, DCT, DST, KLT,– definition, properties and applications

UNIT II
FOURIER ANALYSIS:
Vector space, Hilbert spaces, Fourier basis, FT- Limitations of FourierAnalysis, Need for time-frequency analysis, DFT, 2D-DFT: Definition, Properties andApplications, IDFT, Hilbert Transform, STFT.

UNIT-III
CONTINUOUS WAVELET TRANSFORM (CWT):
Short comings of STFT, Need for wavelets, WaveletBasis- Concept of Scale and its relation with frequency, Continuous time wavelet TransformEquation- Series Expansion using Wavelets- CWT- Tiling of time scale plane for CWT, Important Wavelets: Haar, Mexican Hat, Meyer, Shannon, Daubechies.

UNIT-IV
MULTI RATE ANALYSIS AND DWT:
Need for Scaling function – Multi Resolution Analysis, Two Channel Filter Banks, Perfect Reconstruction Condition, Relationship between Filter Banks and Wavelet Basis, DWT, Structure of DWT Filter Banks, Daubechies Wavelet Function, Applications of DWT.

UNIT-V
SPECIAL TOPICS:
Wavelet Packet Transform, Multidimensional Wavelets, Bi-orthogonal basis- BSplines, Lifting Scheme of Wavelet Generation, Multi Wavelets

TEXT BOOKS:

1. **Raghuveer M.Rao and Ajit S.Bopardikar, "Wavelet Transforms-Introduction theory and applications", First Edition, Pearson Edu, Asia, New Delhi, 2010.**
2. **Soman. K. P, Ramachandran and K.I, Printice "Insight into Wavelets from Theory to practice", First Edition, PHI, 2009.**

REFERENCES:

1. M.Jayaraman, S.Esakkirajan, T.Veera Kumar, "Digital Image Processing" , TMH, 2009
2. Jaideva C Goswami,and Andrew K Chan "Fundamentals of Wavelets- Theory, Algorithms and Applications", John Wiley & Sons, Inc, Singapore, 1999.
3.Vetterli M. Kovacevic, "Wavelets and sub-band coding", PJI, 1995.
4. C. Sydney Burrus, "Introduction to Wavelets and Wavelet Transforms", First Edition, PHI, 1997.
5. Stephen G. Mallat "A Wavelet Tour of Signal Processing", Second Edition, Academic Press,2008.

E-REFERENCES:

1. Transform Techniques
   https://en.wikipedia.org/wiki/List_of_transforms

2. NOC:Transform Techniques for Engineers - NPTEL
   https://nptel.ac.in/courses/111/106/111106111/

ELECTIVE-I	L	T	P	C
	3	-	-	3
19CS5E19: OPERATING SYSTEMS CONCEPTS				

COURSE OUTCOMES:

At the end of the course student are able to

1. Define the Basic concepts about Operating System and its functions.
2. Describe Process management, CPU scheduling and Deadlocks.
3. Analyze Memory management
4. Describe and Implement File systems & Disk Structures .
5. Perform Case Study on LINUX,WINDOWS and Android OS

UNIT – I

OPERATING SYSTEMS OVERVIEW

Introduction-OS Concepts – Evolution of OS, OS Structures- Kernel, Shell. Operating-System Services, System Calls, Types of System Calls, System Structure. UNIX- Introduction-Architecture, Logging In, Files and Directories, Input and Output, Programs and Processes, Error Handling, User Identification, Time Values, System Calls and Library Functions, Command-Line Arguments, UNIX File API'S.

UNIT – II

PROCESS MANAGEMENT

Process: Concept, Operations on Processes, Inter process Communication. Threads-Multithreading Models, Threading Issues, threads .

Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Critical Regions, Monitors, Classic Problems of Synchronization,

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms- CPU (Uniprocessor) scheduling algorithms, Multiprocessor and Real-time scheduling algorithms.

Deadlocks: Characterization – Prevention – Avoidance - Detection and Recovery

UNIT – III

MEMORY MANAGEMENT

Basic Memory Management, Swapping, Contiguous Memory Allocation, Virtual Memory Concept, Demand Paging - Page Interrupt Fault, Page Replacement Algorithms, Segmentation – Simple, Multi-level, Segmentation with Paging, Memory Management.

UNIT – IV

INFORMATION MANAGEMENT

File system Interface: The concept of a file, Access Methods, Directory structure, File system mounting, file sharing, protection.

File System implementation: File system structure, allocation methods, free-space management

Mass-storage structure: Overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, Disk Management, Swap-Space Management, RAID Structure.

UNIT – V

CASE STUDY

The Linux System, Microsoft Windows 7, Android Software Platform**:** Android Architecture, Operating System Services, Android Runtime Application Development, Application Structure.

TEXT BOOK:

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 10th Edition, John Wiley and Sons Inc., 2018.
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2016.
3. Operating Systems-S Halder, Alex A Aravind,Second Edition,Pearson Education,2016 .

REFERENCE BOOKS:

1.“Understanding Operating Systems”Ann McIver McHoes Ida M. Flynn, Sixth Edition,Course Technology-Cengage Learning ,2011.
2. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley, 2001.
3. Operating Systems Design and Implementation, Andrew S. Tanenbaum , Albert S. Woodhull - Amherst, Third Edition Prentice Hall, 2006.
4. Advanced Programming in UNIX Environment, by W. Richard Stevens: 2nd Ed, Pearson Education, 2005.
5. UNIX System Programming Using C++,by Terrence Chan: Prentice Hall India, 1999.
6. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIScBANG/Operating%20Systems/New_index1.html

SEMESTER-VI	L	T	P	C
	3	1	-	4
19EC6T01: DIGITAL SIGNAL PROCESSING				

COURSE OUTCOMES:

After the completion of this course, students are able to

CO1: Analyze the Discrete system in Time and Frequency domain through its respective tools
CO2: Demonstrate about Fourier series, DFT and to solve the FFT using DIT & DIF algorithms
CO3: Apply Z-transform and Discrete Fourier transform to analyze a digital system.
CO4: Design IIR and FIR digital filters for various applications.

UNIT I
INTRODUCTION:
Introduction to Digital Signal Processing: Discrete time signals & sequences,
Classification of Discrete time systems , stability of LTI systems, Invertability, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms, solution of difference equations using Z-transforms, System function.

UNIT II
DISCRETE FOURIER SERIES & FOURIER TRANSFORMS:
Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

UNIT III.
DESIGN OF IIR DIGITAL FILTERS& REALIZATIONS:
Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.

UNIT IV
DESIGN OF FIR DIGITAL FILTERS & REALIZATIONS:
Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique, Comparison of IIR & FIR filters. Basic structures of FIR systems, Lattice structures, Lattice-ladder structures.

UNIT V
MULTIRATE DIGITAL SIGNAL PROCESSING:
Introduction, Decimation , Interpolation Sampling rate conversion ,Implementation of sampling rate converters, Applications – Sub-band Coding of Speech Signals, Implementation of Digital Filter Banks, Trans-multiplexers.

TEXT BOOKS:

1. John G. Proakis, Dimitris G.Manolakis, "Digital Signal Processing, Principles, Algorithms, and Applications", Pearson Education / PHI, 2007. **(Unit I-V)**
2. Ramesh Babu, "Digital Signal Processing", Sci Tech publications, 2010 **(Unit I-V)**

REFERENCES:

1. A.V.Oppenheim and R.W. Schaffer , "Discrete Time Signal Processing",1st edition, PHI, 2014.
2. B.Venkataramani, M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" ,TATA McGraw Hill, 2002
3. K Raja Rajeswari , "Digital Signal Processing", 1st edition,I.K. International Publishing House, 2012.

E-REFERENCES:

1. Digital Signal processing, NPTEL
   https://nptel.ac.in/courses/108/106/108106151/

2. Digital Signal processing, Tutorialspoint
   https://www.tutorialspoint.com/digital_signal_processing/index.htm

SEMESTER-VI	L	T	P	C
	3	-	-	3
19EC6T02: VLSI DESIGN				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Explain the operation of MOSFET and the fabrication of various MOSFETS
CO2: Understand the basic electrical properties of MOS circuits
CO3: Analyze the CMOS circuit design processes and scaling of MOS circuits
CO4: Design the logic circuits using VHDL, test and understand the Implementation strategies.

UNIT I

INTRODUCTION TO MOS TRANSISTORS AND ITS FABICATION:

IC Technology and its Era. Types of MOSFET - Enhancement and Depletion modes Construction and operation of MOSFET, Fabrication of NMOS, PMOS, CMOS-N well-P well and Bi-CMOS fabrication processes, Introduction to Gallium Arsenide (GaAs) Devices and FinFET.

UNIT II

BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS AND SCALING :

Ids-Vds relationships-non saturated region-saturated region, Aspects of MOS transistor Threshold Voltage, Trans-conductance, Output Conductance and Figure of Merit, The pass transistor and NMOS Inverter. Determination of pull-up to pull-down Ratio of NMOS Inverter driven by another NMOS inverter and driven through one or more pass transistors, Latch-up in CMOS circuits.

Scaling- Scaling factors for different Device Parameters-Limitations of scaling.

UNIT-III

MOS CIRCUIT DESIGN PROCESSES:

CMOS circuit diagram- Stick Diagram and Layout diagram, Design Rules for layout diagram-Lambda based design rules and micron based design rules, Sheet Resistance, and its concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, and some examples of its calculations.

UNIT-IV

IMPLEMENTATION STRATEGIES AND TESTING:

ASIC Design using Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures, CPLD.

Design for Testability (DFT)-Boundary Scan Test (BST)-Built In Self Test (BIST).

UNIT-V

DIGITAL DESIGN USING HDL:

Introduction to HDL and History of VHDL, VHDL requirements,Various design styles of VHDL- Data flow modelling- Behavioural modelling-Structural modelling, VHDL program to design the circuits using all the three modelling- half adder, full adder, multiplexer, demultiplexer, decoder, encoder, Universal Shift Register and counter .

TEXTBOOKS:

1. Kamran Eshraghian, Eshraghian Dougles and A.Pucknell, and Sholeh Eshraghian, "Essentials of VLSI Circuits and Systems", 1st Edition, PHI, 2005. **(UNIT-I,II,III,IV)**
2. J.Bhaskar, "VHDL Primer",3rd Edition, Prentice Hall Of India Publications, 2015.**(UNIT-V)**

REFERENCES:

1. A.Albert Raj & T.Latha, "VLSI Design", PHI Learing Private Limited, 2015.
2. K.Lal Kishore and V.S.V.Prabhakar, "VLSI Designing", First Edition, I.K.International Publishing House Private Limited, 2017.
3. Dr.K.V.K.K.Prasad, Kattula Shyamala , "VLSI Design – Black Book", 2017 Edition, Kogent Learning Solutions Inc.

E-REFERENCES

1. VLSI Design Tutorial,
   https://www.tutorialspoint.com/vlsi_design/index.htm

2. NPTEL,VLSI Design,
   https://nptel.ac.in/courses/117/101/117101058/#

SEMESTER-VI	L	T	P	C
	-	-	3	1.5
19BM6T01: MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS				

UNIT–I Managerial Economics and Demand Analysis: Definition – Nature and Scope of Managerial Economics - Relation with other disciplines - Concept of Demand-Types-Determinants - Law of Demand - Elasticity of Demand - Types and Measurement-Demand forecasting.

UNIT–II Production and Cost Analysis: Production function - Law of Variable proportions - Isoquants and Iso costs -Law of returns- Economies of Scale - Cost Concepts - Cost Volume Profit Analysis – Applications of BEP (Simple Problems).

UNIT-III Market Structures and Pricing Policies: Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly – Features – Price & Output Determination - Pricing Methods

UNIT-IV Forms of Organizations and Business Cycles: Business Organization- Sole Trader – Partnership - Joint Stock Company - State/Public Enterprises and their forms - Business Cycles: Meaning and Features - Phases of Business Cycle.

UNIT–V Capital Budgeting and Accounting: Concept and sources-Techniques of evaluating capital budgeting(Simple problems)
Introduction to Accounting: Branches-Systems of Accounting-Single Entry-Double Entry System-Journal-Ledger-Trail Balance-Final Accounts-Ratio Analysis(Simple problems)

TEXTBOOKS:
1. Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.
2. T.V.Ramana& B. Kuberudu: Managerial Economics and Financial Analysis, Himalaya Publishing House,Mumbai
3. Varshney &Maheswari: Managerial Economics, Sultan Chand, 2003.

REFERENCE BOOKS:
1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Ed.
3. Suma Damodaran, Managerial Economics, Oxford University Press.
4. Lipsey &Chrystel, Economics, Oxford University Press.
5. S. A. Siddiqui & A. S. Siddiqui, Managerial Economics & Financial Analysis, New age International Space Publications.
6. Domnick Salvatore: Managerial Economics in a Global Economy, 4th Edition, Thomson. 7. Narayanaswamy: Financial Accounting A Managerial Perspective, PHI.
8. Raghunatha Reddy &Narasimhachary: Managerial Economics& Financial Analysis, Scitech.
9. S.N.Maheswari& S.K. Maheswari, Financial Accounting, Vikas.

SEMESTER-VI	L	T	P	C
	-	-	3	1.5
19EC6L02:VLSI DESIGN LAB				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Understand the fundamental concepts of hardware description language (HDL).
CO2: Work with the software such as Xilinx ISE and Mentor Graphics Tool for front end and back end design.
CO3: Design and simulate combinational and sequential digital circuits using VHDL language.
CO4: Develop different logic gates and logic cells using micro wind tool

Minimum Twelve Experiments 8 from Part-A and 4 from Part-B to be conducted:

PART-A

The students need to develop VHDL Source code using any one of the modeling- Data Flow, Behavioural and Structural. The simulation has to be performed using relevant simulator (Xilinx/Mentor Graphics)

Design the following circuit using VHDL coding

1. Logic Gates
2. Half Adder and Full Adder
3. Binary Encoder and Binary Decoder
4. 32:1 Multiplexer using 8:1 Multiplexers
5. 1:16 Demultiplexer
6. 4-bit Ripple carry and carry look ahead adder
7. 4 bit Magnitude Comparator
8. Flip Flops-DFlip-flop /T- Flip-flop/JK- Flip-flop
9. 8-bit synchronous up-down counter
10. PIPO Shift register
11. Universal shift register
12. 4-bit/8-bit parity generator and checker
13. Develop VHDL code for various logic functions
14. Develop VHDL code for various logic Diagrams.

PART-B (Back-end Level Design and Implementation)

The students need to design the following experiments at schematic level using CMOS logic and verify the functionality. Further students need to draw the corresponding layout and verify the functionality including parasites. Available state of the art technology libraries can be used while simulating the designs using Industry standard EDA Tools.

Design and Implement the following

1. Universal Gates
2. An Inverter
3. Half Adder
4. Half Subtractor
5. Decoder
6. D Flip-flop
7. SRAM cell

EQUIPMENT REQUIRED FOR LABORATORY:

1. Xilinx -ISE/Mentor Graphics Software or Equivalent Industry Standard Tool.
2. Microwind
3. FPGA Trainer Kits

SEMESTER-VI	L	T	P	C
	-	-	3	1.5
19EC6L01: DIGITAL SIGNAL PROCESSING LAB				

COURSE OUTCOMES:

After this course, students are able to

CO1: Apply the basics of MATLAB and C-languages for the development of various DSP applications.
CO2: Analyze the various applications by transforming the input sequence using FFT algorithm.
CO3: Design IIR and FIR digital filters and use them in different applications.
CO4: Develop various real time applications using digital signal processor such as TMS3206713/ TMS6712.

LIST OF EXPERIMENTS

1. Introduction To Matlab
2. To Generate Basic Discrete-Time Sequences
3. To Compute FFT and IFFT
4. To find the Sum of Sinusoidal Signals
5. To find the Response of LTI Discrete-Time System
6. To find the Frequency Response of LTI Discrete-Time System
7. To Study the architecture of DSP chips-TMS 320C 5X/6X Instructions.
8. To verify Linear Convolution
9. To verify Circular Convolution
10. To compute Power Density Spectrum sequence

PART-2 (FILTERS)

1. Frequency Response of IIR low pass Butterworth Filter
2. Frequency Response of IIR high pass Butterworth Filter
3. Frequency Response of IIR low pass Chebyshev Filter
4. Frequency Response of IIR high pass Chebyshev Filter
5. Frequency Response of FIR low pass Filter using Rectangle Window
6. Frequency Response of FIR low pass Filter using Triangle Window

OPEN ENDED EXPERIMENTS:

1. To Generate DTMF Signal
2. To Implement the Decimation Process.
3. To Implement the Interpolation Process.
4. To Implement the I/D Sampling Rate Converters.

SEMESTER-VI	L	T	P	C
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19HS6L03: ADVANCED ENGLISH COMMUNICATION SKILLS LAB				

At the end of the course students will be able to prepare themselves for their career which may require them to listen and speak in English both for their professional and interpersonal communication in the globalized context.

Course objectives

- Analyzing a topic of discussion and relating to it.
- Planning and executing an assignment creatively.
- Presenting ideas coherently within a stipulated time.
- Communicating ideas effectively in prescribed oral activities.
- Applying relevant writing formats for resume and presentations.
- Facing interviews with confidence.

Course outcomes

At the end of the course students will be able to

- Gather ideas and organize information relevantly and coherently
- Participate in group discussions and face interviews with confidence
- Write Resume with covering letter
- Make oral presentations and public speaking
- Take part in social and professional communication.

The following course content is prescribed for the **Advanced English Communication Skills Lab:**

UNIT I

Communication Skills

- Introduce Yourself
- JAM
- J2M

➢ Identifying one's career objective, projecting strengths and skills, organization of ideas within given time.

UNIT II

Interaction Skills

- Body Language
- Role- Plays

➢ Students start a conversation - Respond appropriately and relevantly in different situations with right body language.

UNIT III

Oral Skills

- Presentations
- Public Speaking

➢ Planning preparation and presentation - organization of ideas with clarity , coherence and style.

UNIT IV

Writing Skills

- Covering Letter
- Resume Writing

➢ To communicate the ideas relevantly and coherently in writing.

UNIT V

Team Work Skills

- Group Discussion

➢ Dynamics of Group Discussion - Modulation of voice, Body language , relevance , fluency and coherence.

UNIT VI

Interview Skills

➢ Pre-interview planning, opening strategies, answering strategies, interview through tele and video conference.

Reference Books:

1. Ashraf Rizvi- Effective Technical Communication - McGraw Hill Education- 2017.

2. Madhavi Apte - A Course in English Communication – Prentice - Hall of India- 2007.

3. Dr. Shalini Verma - Body Language – Your Success Mantra- S. Chand- 2006.

4. Sunita Mishra & C.Murali Krishna- Communication Skills for Engineers - Pearson Education - 2007.

SEMESTER-VI	L	T	P	C
	2	-	-	0
19BM0M03: INDIAN CONSTITUTION				

UNIT I: Introduction to Indian Constitution-Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT II: Union Government and Administration Structure of the Indian Union: Federalism, Centre State relationship, President: Role, powers and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions

UNIT III: State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT IV:.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions of Pachayat Raj Institution: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy.

UNIT V:Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate -State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women.

TEXTBOOKS:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India Pvt. Ltd.
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics

REFERENCE BOOKS:

1. D.C. Gupta, Indian Government and Politics
2. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
3. J.C. Johari, Indian Government andPolitics Hans
4. J. Raj IndianGovernment and Politics
5. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
6. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.

e-Resources:

1) nptel.ac.in/courses/109104074/8
2) nptel.ac.in/courses/109104045/
3) nptel.ac.in/courses/101104065/
4) www.hss.iitb.ac.in/en/lecture-details
5) www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

ELECTIVE-II	L	T	P	C
	3	-	-	3
19EC5E04: DIGITAL SYSTEM DESIGN				

COURSE OUTCOMES:

Upon completion of the course, Students are able to understand

CO1: The design of Combinational and Sequential logic circuit.

CO2: The FSM and asynchronous and synchronous state machines.

CO3: The classification of logic families.

CO4: The FSM & HDL Design flow.

UNIT 1: Combinational and Sequential logic circuit design

Combinational circuits:

Half adder full adder, BCD adder, code converters, magnitude comparator, multiplexers and decoders.

Sequential circuits:

Flip Flops-SR, JK, T, D and master-slave FF, ripple and synchronous counters, shift registers.

UNIT 2: Sequential Machines

Capabilities, Minimization and Transformation, The finite state model and definitions, Capabilities and Limitations of Finite State machines.

UNIT 3: Synchronous state machine design

Sequential counters, state changes referenced to clock, number of state flip-flops, input forming logic, output forming logic, generation of a state diagram from a timing chart, redundant states, general state machine architecture, Concept of asynchronous and synchronous state machine.

UNIT 4: Logic families

Specifications, noise margin, propagation delay, fan-in, fan-out, Transistor-Transistor Logic (TTL), Emitter-Coupled Logic (ECL), CMOS Logic, TTL and CMOS Gates, Introduction to basics of FINFET.

UNIT 5: VLSI Design flow

Schematic, FSM & HDL, different modeling styles in Verilog: Behavioral and Structural Modeling, Data types and objects, Synthesis and Simulation Verilog constructs and codes for combinational and sequential circuits.

TEXT BOOKS:

1. Modern Digital Electronics – R. P. Jain, 3rd Edition, Tata McGraw-Hill, 2007. (UNIT I-IV)
2. *J Bhaskar, "A Verilog HDL Primer ", 3rd edition,Kluwer, 2005.(Unit V)*

REFERENCES:

1. Switching and Finite Automata Theory - Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge, 2010.
2. Digital Design- Morris Mano, PHI, 4th Edition,2006
3. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed, January 2009.
4. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.
5. Switching Theory and Logic Design – A Anand Kumar, PHI, 2013

E-REFERENCES:

1. Digital Systems Design
   https://nptel.ac.in/courses/108/106/108106177/

2. Digital Systems Design
   https://ec.europa.eu/programmes/erasmus-plus/project-result-content/9f367412-e981-4a64-b01a-1157cbc933f5/Digital%20Systems%20Design.pdf

ELECTIVE-II	L	T	P	C
	3	-	-	3
19EC6E05: RADAR AND SATELLITE SYSTEM				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Explain the basic concepts of radar system.

CO2: Describe the operation and applicability of CW radar and MTI Radar.

CO3: Summarize the detection of radar and its noise performance.

CO4: Demonstrate the historical back ground of satellite communications and Orbital Mechanics.

UNIT-I: BASICS OF RADAR SYSTEM: Nature of Radar, Maximum Unambiguous Range. Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications.Related Problems. Radar Equation: Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Probability Density Function and SNR, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets-sphere, cone-sphere). Transmitter power.PRF and Range Ambiguities, System Losses (Qualitative treatment), Antenna Parameters .Related Problems.

UNIT-II:RADAR TECHNOLOGY: Doppler effect, CW Radar, Non-zero IF Receiver, Receiver Bandwidth Requirement, Applications of CW radar. FMCW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), MTIR Radar with Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers - Filter Characteristics, Blind Speeds, Double Cancellation staggered PRFs, MTI Radar Parameters, Limitations to MTI Performance, Two frequency MTI, Area MTI.

UNIT-III:DETECTION OF RADAR SIGNALS IN NOISE: Introduction, Matched Filter Receiver - response Characteristics and Derivation, Correlation detection, Detection criteria, Detector characteristics, Automatic Detection, Constant False Alarm Rate Receiver, Performance of the Radar Operator.

UNIT-IV: INTRODUCTION TO SATELLITE: Origin of Satellite Communications, Historical Back-ground, Introduction to Polar, geo-synchronous and geo-stationary satellites, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

UNIT-V: ORBITAL MECHANICS AND LAUNCHERS: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance, Indian scenario in Communication Satellite.

TEXT BOOKS:

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt , “Satellite Communications”,2nd Edition, Wiley, 2003 **(UNIT I -V).**

REFERENCES:

1. Merrill I. Skolnik , "Introduction to Radar Systems", 2nd edition, McGraw Hill ,1981**.**
2. Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud , "Satellite Communications Engineering", 2nd Edition, Pearson Publications,2003.
3. K.N. Raja Rao , "Fundamentals of Satellite Communications", PHI, 2004.
4. Byron Edde , "Radar: Principles, Technologies, Applications", Pearson Education, 2000

E-REFERENCES:

1. Space based Radar
   https://en.wikipedia.org/wiki/Space-based_radar
2. Satellite Communication Systems, NPTEL
   https://nptel.ac.in/courses/117/105/117105131/
3. Principles and Techniques of Modern Radar Systems, NPTEL
   https://nptel.ac.in/courses/108/105/108105154/

ELECTIVE-II	L	T	P	C
	3	-	-	3
19CS6E20: COMPUTER NETWORKS				

COURSE OUTCOMES

At the end of the course students are able to

1. Differentiate Network Referenc**e** models such as OSI**,** TCP/IP
2. Classify various Data link layer protocols such as sliding window.
3. Distinguish Various MAC sub layer protocols such as ALOHA, CSMA, CSMA/CD
4. Differentiate various Network layer protocols and its applications
5. Distinguish various Transport layer protocols and its applications
6. Illustrate various application layer protocols such as WWW and HTTP etc.

UNIT 1:

Data communication Components: Representation of data and its flow of networks, Categories of Networks, Various Connection Topologies, Protocols and Standards, OSI network model, TCP/IP Protocol suit, Transmission Media.

UNIT 2:

Data Link Layer: Error Detection and Error Correction -Fundamentals, Block coding, Hamming Distance, CRC, Flow Control and Error control protocols - Sliding Window Protocols: Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Piggybacking,

UNIT3:

Medium Access Sub Layer: Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.

Network Layer: Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP– Delivery,

UNIT 4:

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Congestion control, Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT 5:

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP.

Text Books:

1. Data Communication and Networking, 5th Edition, Behrouz A. Forouzan, Mc GrawHill, 2017
2. Computer Networks, 6th Edition, Andrew S. Tanenbaum, Pearson New International Edition, 2021.
3. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India, 2007

Reference Books:

1. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.

TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

ELECTIVE-II	L	T	P	C
	3	-	-	3
19EC6E06: DIGITAL IMAGE PROCESSING				

COURSE OUTCOMES:

After the completion of this course, students are able to

CO1: Define basic concepts of image processing and image geometry.
CO2: Apply various operations on image both in spatial and frequency domains to solve various real time problems by converting them between domains.
CO3: Differentiate different types of images, such as black & white, grayscale and color images, and can convert image from one color model to other.
CO4: Analyze different features of the images for the purpose of Compression, authentication and safety.

UNIT-I
BASICS OF DIGITAL IMAGE PROCESSING:
Origins of digital image processing, uses digital image processing, fundamental steps in digital image processing, components of an image processing system, digital image fundamentals, Elements of visual perception, light and electromagnetic spectrum, imaging sensing and acquisition, image sampling and quantization. Some basic relationships between pixels**.**

UNIT-II
INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING:
Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Filtering in the frequency domain: Preliminary concepts, the discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform. The Basic of filtering in the frequency domain, image smoothing and sharpening using frequency domain filters.

UNIT-III
IMAGE RESTORATION AND RECONSTRUCTION:
A model of the image degradation Restoration process, Noise models, restoration in the presence of noise only- Spatial Filtering - Mean filters, order statistic filters and adaptive filters.
Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean
square error (Wiener) filtering, constrained least squares filtering ,geometric mean filter, image reconstruction from projections.

UNIT-IV
MULTI-RESOLUTION PROCESSING AND IMAGE COMPRESSION:
Image pyramids, sub-band coding & Haar transforms multi resolution expressions, wavelet transforms in one dimension. The fast wavelets transform, wavelet transforms in two dimensions, wavelet packets. Image compression: Fundamentals, various compression methods-coding techniques, digital image water marking.

UNIT-V

MORPHOLOGICAL IMAGE PROCESSING, SEGMENTATION AND COLOR IMAGE PROCESSING:

Preliminaries Erosion and dilation, opening and closing, the Hit-or-miss transformation, some Basic Morphological algorithms, Image segmentation- Fundamentals, point, line, edge detection thresholding, region -based segmentation, color fundamentals, color models, pseudo color image processing, basic of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

TEXT BOOKS:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing, 3rd edition", Prentice Hall, 2008. (UNIT I-V)

REFERENCES:

1. R. C. Gonzalez, R. E. Woods and Steven L. Eddins , "Digital Image Processing Using MATLAB" 2nd edition, Prentice Hall, 2009.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar, "Digital Image Processing", Tata McGraw-Hill Education, 2011.

E-REFERENCES:

1. Digital Image Processing, Tutorialspoint https://www.tutorialspoint.com/dip/index.htm
2. Digital Image Processing, Javatpoint https://www.javatpoint.com/digital-image-processing-tutorial

ELECTIVE-II	L	T	P	C
	3	-	-	3
19CS6E21: DATABASE MANAGEMENT SYSTEMS				

COURSE OUTCOMES

Upon successful completion of this course, students should be able to:
CO1: Explain the basic concepts of database management system and design an Entity-Relationship (E-R) model and convert E-R model to relational model.
CO2: Construct database using Relational algebra and SQL.
CO3: Apply Normalization techniques to normalize the database.
CO4: Discuss transaction management using different concurrency control protocols and Recovery algorithms.
CO5: Illustrate different file organization and indexing methods.

UNIT-1

Introduction-Database System Applications, Purpose of Database Systems, View of Data - Data Abstraction, Instances and Schemas, Data Models, Database Languages , Database Architecture, Database Users and Administrators.

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model.

Relational Model: Introduction to the Relational Model - Integrity Constraints over Relations.
Enforcing Integrity constraints, querying relational data, Logical data base Design, Views.

UNIT-II

Relational Algebra: Relational Algebra - Selection and Projection, Set operations, Renaming, Joins, Division.

SQL: Form of Basic SQL Query - Examples of Basic SQL Queries, UNION, INTERSECT, and EXCEPT, Introduction to Nested Queries, Correlated Nested Queries, Set Comparison Operators, Aggregate Operators, NULL values - Comparison using Null values - Logical connectives - AND, OR and NOT - Outer Joins, Disallowing NULL values, Triggers.

UNIT-III

SCHEMA REFINEMENT AND NORMAL FORMS: Introduction to Schema Refinement - Problems Caused by redundancy, Decompositions - Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms - FIRST, SECOND, THIRD Normal forms - BCNF - Properties of Decompositions - Loss less join Decomposition, Dependency preserving Decomposition, Multi valued Dependencies - FOURTH Normal Form, Join Dependencies, FIFTH Normal form.

UNIT-IV

Transaction Management - The ACID Properties - Transactions and Schedules- Concurrent Execution of Transactions- Lock-Based Concurrency Control- 2PL, Serializability, and Recoverability- Dealing With Deadlocks - Concurrency Control without Locking.

CRASH RECOVERY: Introduction to ARIES- The Log - The Write-Ahead Log Protocol – Checkpoints - Recovering from a System Crash (ARIES) - Media Recovery.

UNIT-V

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing- Clustered Indexes, Primary and Secondary Indexes, Index data Structures - Hash Based Indexing, Tree based Indexing, Comparison of File Organizations.

Tree Structured Indexing: Intuitions for tree indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

TEXT BOOKS:

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, McGrawHill Education, 3rd Edition, 2014.
2. Data base System Concepts, A.Silberschatz, H.F. Korth, S.Sudarshan, McGraw Hill, 6^{th} edition, 2016.

Reference Books:

1. Fundamentals of Database Systems, RamezElmasri, Shamkant B Navathe-7^{th} Edition, 2016.
2. Introduction to Database Systems, 8/e, C.J. Date, Pearson, 2012.
3. Database System Design, Implementation and Management, 5/e, Rob, Coronel, Thomson, 2012.

SEMESTER-VII	L	T	P	C
	3	-	-	3
16EC7T01: MICROWAVE AND OPTICAL COMMUNICATION				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Summarize about different types of modes in wave guides and how to decrease the transmission and power losses, different types of microwave solid state devices and their applications

CO2: Attain the knowledge about how these microwaves are generated transmitted, amplified and finally measured using Passive devices.

CO3: Describe the fundamentals, advantages, Ray theory transmission in Optical Communication and effect of dispersion of the signal, types of fiber materials, different losses in fibers

CO4: Gain knowledge about Optical transmitters, receivers and estimation of link and power budget analysis.

UNIT-1: WAVEGUIDES:

Microwave Spectrum, Bands, Applications and Advantages of Microwaves, Rectangular Waveguides TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Dominant and Degenerate Modes, Phase and Group Velocities, Wavelengths and Impedance Relations, Power Transmission and Losses in Rectangular wave guide, Impossibility of TEM mode.

UNIT-2: MICROWAVE ACTIVE&PASSIVE DEVICES:

Gunn Diode Principle, Two Valley Model Theory/RWH Theory, Characteristics Modes , Principle of Operation of IMPATT and TRAPATT diodes, Tunnel diode, Varacter diode, Step recovery diode and PIN diode, Two Cavity Klystron Amplifier, Reflex Klystron Oscillator Modes and Efficiency considerations and Cylindrical Magnetron.

Scattering parameters E and H-Plane Tees, Hybrid Ring (Rat-Race), Two hole Directional Coupler, Power divider, Fixed and Variable Attenuators, Ferrite Devices.

UNIT - 3: MICROWAVE ANTENNAS AND MEASUREMENTS:

Description of Microwave bench, and their features, precautions, VSWR Meter, Frequency Meter, Power Meter ,Slotted line section, Measurement of Attenuation, Frequency, Impedance, Power, VSWR, CavityQ, Dielectric constant, measurement of a solid.

UNIT – 4: OPTICAL FIBERS AND DEVICES:

Historical development, The general system, advantages and applications of OFC, Propagation of light Optical fiber structures, Acceptance angle, Numerical aperture, Attenuation,Absorption and Scattering losses,single mode fiber connector,Dispersion, Radiation losses Splicing Technique Optical Fiber connector, an d their types.

UNIT – 5: OPTICAL NETWORKS:

Optical Source – LED's Structures Materials, Quantum efficiency, Power, Modulation and Power band width product, ILD characteristics, Optical Detectors – PIN and APD characteristics, Optical transmitters and receivers, System block diagram, Point to point link design, Power budget analysis, Line coding in optical links, WDM- DWDM.

TEXT BOOKS:

1. Samuel Y. Liao, "Microwave Devices and Circuits", 3rd Edition, PHI, 1994 **(Unit I-V)**

REFERENCES:

1. G.S.N. Raju , "Microwave Engineering", IK International Publishers, New Delhi,2008
2. Gerd Keiser, "Optical Fiber Communications", 4th Edition, McGraw Hill Companies, 2008.
3. John. M. Senior , "Optical Fiber Communications Principles and Practice" 2nd Edition, PHI, 1992.

E-REFERENCES:

1. Introduction to Microwave Engineering, NPTEL
   https://nptel.ac.in/courses/108/103/108103141/
2. Fiber Optic Communication Technology, NPTEL
   https://nptel.ac.in/courses/108/106/108106167/

SEMESTER-VII	L	T	P	C
	3	-	-	4
19EC7T02: EMBEDDED SYSTEMS				

COURSE OUTCOMES:

After completion of the course, students are able to
CO1: Acquire a basic knowledge about fundamentals of Embedded Systems
CO2: Acquire a basic knowledge about various components used in Embedded systems
CO3: Understand about the PIC, AVR controllers and Processors
CO4: Perform the design case study of Embedded Systems

UNIT-I: Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT-II: Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT-III: Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT-IV: Overview of PIC, AVR controllers and ARM processors: Introduction to PIC family of Microcontroller. Introduction to AVR family of Microcontroller. Introduction to ARM family Processors

UNIT-V: Design Case studies: Digital clock, Battery operated smartcard reader, Automated meter reading system, Digital camera

TEXT BOOKS:

1. Shibu K.V, "Introduction to Embedded Systems", McGraw Hill, 2014 **(Unit I-V)**

REFERENCE BOOKS:

1. Raj Kamal, "Embedded Systems", TMH.2003
2. David E Simon, "An Embedded Software Primer", Pearson Education, 2015.

E-REFERENCES:

1. Embedded Systems
https://archive.org/details/K.ShibuIntroductionToEmbeddedSystemsTmh2009/page/n5/mode/2up?view=theater

SEMESTER-VII	L	T	P	C
	-	-	4	2
19EC7L01: MICROWAVE & OPITCAL COMMUNICATION LAB				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1. Summarize about different types of modes in wave guides and characteristics
CO2. Interpret different types of components which are using in microwave communication.
CO3. Analyze the optical fiber components such as sources, detectors and amplifiers.
CO4. Explain the key features of optical fiber, and describe various types of optical fibres and coupling losses

Minimum Twelve Experiments 7 from Part-A and 5 from Part-B to be conducted:

PART-A (Any-7)

1. Reflex Klystron Characteristics.
2. Negative Resistance characteristics of Gunn Diode.
3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. Microwave Frequency Measurement.
6. VSWR Measurement (LOW & HIGH).
7. Measurement of scattering parameters of E-Plane Tee.
8. Measurement of scattering parameters of Circulator.
9. Measurement of scattering parameters of Magic Tee.

PART-B(Any-5)

1. Characteristics of Light Emitting Diode.
2. Characteristics of LASER.
3. Study of propagation loss in Optical fiber.
4. Measurement of Data rate for Digital Link.
5. Radiation pattern measurement of Antenna.
6. Setting up Fiber Optics voice link using Frequency Modulation.
7. Measurement of NA.

EQUIPMENT REQUIRED FOR LABORATORY:

1. Microwave Bench-setup
2. Waveguide Components
3. Optical fiber Transmitter, Receiver and Cables

SEMESTER-VII	L	T	P	C
	-	-	4	2
19EC7L02 : EMBEDDED SYSTEM LAB				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Understand basic concepts in the embedded computing systems area
CO2: Determine the optimal composition and characteristics of an embedded system
CO3: Design and program an embedded system at the basic level
CO4: Develop hardware-software complex with the use of the Arduino, CPLD ,and FPGA.

EXPERIMENTS:

1) Timer programming of 8051.
2) Counter programming of 8051.
3) Serial port programming of 8051.
4) 16X2 8bit LCD display interfacing with 8051, and display message
5) 16X2 4bit LCD display interfacing with 8051, and display message
6) Using digital IO in arduino uno
7) Using PWM in arduino uno
8) Using Analog input in arduino uno
9) Using Serial port in Arduino uno
10) ARM programming in C language using KEIL IDE
11) Implement the lighting and winking LEDs of the ARM I/O port via programming
12) Programming in CPLD
13) Programming in FPGA

ELECTIVE-III	L	T	P	C
	3	-	-	3
19EC7E07: ANALOG IC DESIGN				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Understand the behavior of MOS Devices and Small-Signal & Large-Signal Modeling of MOS Transistor.
CO2: Develop different applications using CMOS Amplifiers like Differential Amplifiers, Cascode Amplifiers etc
CO3: To design the Analog CMOS Operational Amplifers for different Analog operations.
CO4: Apply the concepts of Open-Loop Comparators and analyze its performance

UNIT -I:
MODELS IN MOS DEVICES
The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models,

UNIT -II:
ANALYSIS OF ANALOG CMOS SUB-CIRCUITS
MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT -III:
DIGITAL CMOS AMPLIFIERS
Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

UNIT -IV:
CMOS OPERATIONAL AMPLIFIERS
Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT -V:
DIGITAL COMPARATORS
Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

TEXT BOOKS:

1. Philip E. Allen and Douglas R. Holberg, CMOS Analog Circuit Design Oxford University Press, International Second Edition/Indian Edition, 2010. **(UNITS -1,2 &3)**
2. Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Analysis and Design of Analog Integrated Circuits Wiley India, Fifth Edition, 2010**.(UNITS - 4 & 5)**

REFERENCES:

1. David A. Johns, Ken Martin, Analog Integrated Circuit Design Wiley Student Edn, 2013.
2. Behzad Razavi, Design of Analog CMOS Integrated Circuits Prentice hall 3rd edition 2008

E-REFERENCES:

1. Analog IC Design, NPTEL
   https://nptel.ac.in/courses/117/106/117106030/

2. Analog IC Design, IIT Madras
   http://www.ee.iitm.ac.in/~ani/2012/ee5390/lectures.html

ELECTIVE-III	L	T	P	C
	3	-	-	3
19EC7E08: CELLULAR AND MOBILE COMMUNICATIONS				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Compute Hexagonal shaped cells and how these are implemented in real world.

CO2: Explain different types of antenna systems in mobile communication.

CO3: Analyze Handoffs and different types of handoffs and Dropped call rates and their evaluation.

CO4: Describe applications of GSM Architecture and GSM channels, multiple access scheme, TDMA, CDMA.

UNIT-I:

INTRODUCTION:

Evolution of Mobile Communications, Mobile Radio Systems around the world, First, Second, Third Generation Wireless Networks, Wireless Local Loop(WLL), Wireless LANs, Bluetooth, Personal Area Networks(PANs),Examples of Wireless Communication Systems, A Simplified Reference Model, Applications, Analog and Digital Cellular mobile systems.

UNIT-II:

ELEMENTS OF CELLULAR RADIO SYSTEM DESIGN:

General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, consideration of the components of Cellular system. Existing mobile communication technologies.

UNIT-III:

CELLULAR CONCEPT AND MOBILE ANTENNAS:

Introduction, Frequency reuse, Handoff strategies, Interference and System Capacity: Co- Channel Interference, Channel Planning, Adjacent Channel Interference, Power control for reducing interference, Trunking and Grade of Service, Cell Splitting, Sectoring, Repeaters for Range extension, A microcell zone concept. Picocell zone concept, Characteristics, Antennas at Cell site, Mobile Antennas.

UNIT-IV:

MOBILE RADIO PROPAGATION :

Introduction, Free space propagation model, The three basic propagation models-Reflection, Diffraction and Scattering, Two-ray model, Outdoor propagation models, Indoor propagation models, Signal Penetration into building, Small scale multipath Propagation, Parameters of Mobile multipath channels, Types of small scale fading. Cell-site antenna heights and signal coverage cells.

UNIT-V:

CHANNEL ASSIGNMENT AND CELLULAR STANDARDS :

Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, Channel assignment algorithms GSM architecture, GSM channels, multiple access schemes, TDMA, CDMA, 4G evolution- Smart Antenna Techniques.

TEXTBOOKS:

1. Gottapu Sasibhushana Rao, "Mobile Cellular Communication", Pearson International, 2012.
(UNIT - I,II,III &IV)
2. W.C.Y. Lee, "Mobile Cellular Telecommunications", 2nd edition, Tata McGraw Hill, 2006.
(UNIT - V)

REFERENCES:

1. Lee, "Wireless and Mobile Communications", 3rd Edition, McGraw Hill, 2005.
2. William Stallings , Wireless Communications and Networks-, 2nd edition, Pearson Education, 2005.

E-REFERENCES:

1. Introduction to Wireless and Cellular Communication, NPTEL
   https://nptel.ac.in/courses/106/106/106106167/

2. Advanced 3G and 4G Wireless Mobile Communications
   https://nptel.ac.in/courses/117/104/117104099/

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ELECTIVE-III	L	T	P	C
	3	-	-	3
19EC7E09: SENSORS AND INSTRUMENTATION				

COURSE OUTCOMES:

Upon completing this course, the student will be able to

CO1: Understand the concepts of Electrical and Mechanical Transducers
CO2: Explain the measurement and characteristics of various instruments
CO3: Get knowledge about basic Signal Conditioning Elements
CO4: Understand about the feedback in Instruments

UNIT I
ELECTRICAL TRANSDUCERS:
Resistance Thermometers; Interfacing Resistive Transducers to Electronic Circuits; Thermistors-Measurement of Temperature and Thermal Conductivity, Temperature Control; Resistance Strain Gauges-Gauge Factor, Bonded and Unbonded Strain Gauges; Self Generating and Non Self Generating Inductive Transducers; Linear Variable Differential Transformers; Capacitive Transducers – Potentiometric Transducers; Thermoelectric Transducers and Sources of Errors in Thermocouples; Piezoelectric Transducers.

UNIT II
MECHANICAL TRANSDUCERS:
Temperature- Bimetallic Element and Fluid Expansion type Thermometers; Pressure- Manometers and Bourdon Gauges; Force- Balances Liquid Level- Float Systems and Level to Pressure Converters; Flow-Pitot Static Tubes and Turbine type Flow Meters. Hot Wire Anemometer. Proximity Sensors- Reed Sensors, Inductive proximity sensor, Capacitive proximity sensor, Optical sensor with through beam, Ultrasonic sensors.

UNIT-III
MEASUREMENT AND CHARACTERISTICS:

Elements of a Measurement System; Classification of Instruments; Static Performance Parameters; Loading and Impedance Matching; Errors and Uncertainties in Measurement; Process and Standards of Calibration; Dynamic Characteristics Transfer Function Representation of a Measurement System, Impulse and Step Responses of First and Second Order Systems, Frequency Response of First and Second Order Systems.

UNIT-IV
BASIC SIGNAL CONDITIONING ELEMENTS:

Amplifiers- Non Electrical and Electrical types; Op Amps Inverting, Non Inverting, Summing, Differential, and Charge Amplifiers; Differentiating and Integrating Elements; Filters; Data Transmission Elements-Electrical, Pneumatic, Position and Radio Frequency Transmission types; Compensation Elements for First and Second Order Systems – Basic Indicating, Recording, and Display Elements.

UNIT-V

FEEDBACK IN INSTRUMENTS:

Principles of Feedback and Advantages & Disadvantages of Feedback; Digital Voltmeters-Ramp and Dual Slope types; Servo type Potentiometric and Magnetic Tape Recorders; Digital Recorders of Memory type; Data Displays-Analog and Digital types.

TEXTBOOKS:

1. K. Lal Kishor, "Electronic Measurements and Instrumentation", Pearson Education Publications, 2009.
2. H. S. Kalsi , "Electronic Instrumentation", TMH Publications, 2004.
3. Albert D Helfrick and William D Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 2004.

REFERENCES:

1. BC Nakra, and Chaudhry, " Instrumentation, Measurement and Analysis", Tata McGrawHill, 2004.
2. DVS Murthy, "Transducers and Instrumentation", PHI, 2003.
3. CS Rangan, GR Sarma, and VSV Mani, "Instrumentation Devices and Systems", Tata McGraw-Hill,2004.
4. Doeblin and Ernest, " Measurement Systems Application and Design", Tata McGraw-Hill, 2004.

E-REFERENCES:

1. Industrial Instrumentation, NPTEL
   https://nptel.ac.in/courses/108/105/108105064/

ELECTIVE-III	L	T	P	C
	3	-	-	3
19EC7E10: SPEECH PROCESSING				

OUTCOMES:
Upon completion of the course, students will be able to:
CO1: Model speech production system and describe the fundamentals of speech.
CO2: Extract and compare different speech parameters.
CO3: Choose an appropriate statistical speech model for a given application.
CO4: Design a speech recognition system and use different speech synthesis techniques.

UNIT-I:SpeechProcessingFundamentals:
Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts, Short-Time Fourier Transform, Filter-Bank and LPC Methods.

UNIT II SPEECH ANALYSIS
Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT III SPEECH MODELING
Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

UNIT IV SPEECH RECOGNITION
Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

UNIT V SPEECH SYNTHESIS
Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

TEXTBOOKS:
1. Thomas F Quatieri, “Discrete-Time Speech Signal Processing – Principles and Practice”,Pearson Education, 2008.
2. Frederick Jelinek, “Statistical Methods of Speech Recognition”, MIT Press, 1997.

REFERENCES:

1. Lawrence Rabiner and Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.
2. Steven W. Smith, “The Scientist and Engineer‟s Guide to Digital Signal Processing”, California Technical Publishing, 1997.
3. Daniel Jurafsky and James H Martin, “Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education, 2002.
4. Claudio Becchetti and Lucio PrinaRicotti, “Speech Recognition”, John Wiley and Sons, 1999.
5. Ben Gold and Nelson Morgan, “Speech and Audio Signal Processing, Processing and Perception of Speech and Music”, Wiley- India Edition, 2006.

E-REFERENCES:

1. Speech Processing
   https://web.ece.ucsb.edu/
2. Digital Speech Processing
   https://nptel.ac.in/courses/117/105/117105145/

ELECTIVE-III	L	T	P	C
	3	-	-	3
19CS7E24: REAL TIME OPERATING SYSTEM				

Course Educational Objectives:

The objective of the course is to introduce the principles shared by many real-time operating systems, and their use in the development of embedded multitasking applicationsoftware.

Course Outcomes:

After completing the course students will understand the fundamental concepts of real-time operating systems.

UNIT-I

INTRODUCTION:

Introduction to Operating System: Computer Hardware Organization, BIOS and Boot Process, Multi-threading concepts, Processes, Threads, Scheduling

UNIT-II

BASICS OF REAL-TIME CONCEPTS:

Terminology: RTOS concepts and definitions, real-time design issues, examples, Hardware Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building blocks, Real-Time Kernel

UNIT-III

PROCESS MANAGEMENT:

Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals

UNIT-IV

INTER-PROCESS COMMUNICATION:

Messages, Buffers, mailboxes, queues, semaphores, deadlock, priority inversion,

PIPES MEMORY MANAGEMENT:-

Process stack management, run-time buffer size, swapping, overlays, block/page management, replacement algorithms, real-time garbage collection

UNIT-V

CASE STUDIES:

Case study Linux POSIX system, RTLinux / RTAI, Windows system, Vxworks, uItron Kernel Design Issues: structure, process states, data structures, inter-task communication mechanism, Linux Scheduling

TEXT BOOKS:

1. J. J Labrosse, *"MicroC/OS-II: The Real –Time Kernel"*, Newnes, 2002.
2. Jane W. S. Liu, *"Real-time systems"*, Prentice Hall, 2000.

REFERENCES:

1. W. Richard Stevens, *"Advanced Programming in the UNIX® Environment"*, 2nd Edition, Pearson Education India, 2011.
2. Philips A. Laplante, *"Real-Time System Design and Analysis"*, 3rd Edition, John Wley& Sons, 2004
3. Doug Abbott, *"Linux for Embedded and Real-Time Applications",* Newnes, 2nd Edition, 2011.

ELECTIVE-IV	L	T	P	C
	3	-	-	3
19EC8E11: DESIGN FOR TESTABILITY				

COURSE OUTCOMES:

After Completion of this course, students are able to

CO1: Apply the basic concepts in testing which can help them design a better yield in IC design.
CO2: Analyse the various test generation methods for static & dynamic CMOS circuits.
CO3: Identify the design for testability measures for CMOS circuits.
CO4: Recognize the BIST and BST techniques for improving testability.

UNIT I
INTRODUCTION TO TESTING:
Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends affecting Testing, Types of Testing, Fault Modeling: Defects, Errors and Faults, Functional Versus Structural Testing, Levels of Fault Models, Single Stuck-at Fault.

UNIT II
LOGIC AND FAULT SIMULATION:
Simulation for Design Verification and Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-value Simulation, Algorithms for Fault Simulation, ATPG.

UNIT III
TESTABILITY MEASURES:
SCOAP Controllability and Observability, High Level Testability Measures, Digital DFT and Scan Design: Ad-Hoc DFT Methods, Scan Design, Partial-Scan Design, Variations of Scan.

UNIT IV
BUILT-IN SELF-TEST:
The Economic Case for BIST, Random Logic BIST: Definitions, BIST Process, Pattern Generation, Response Compaction, Built-In Logic Block Observers, Test-Per-Clock, Test-PerScan BIST Systems, Circular Self Test Path System, Memory BIST, Delay Fault BIST.

UNIT V
BOUNDARY SCAN STANDARD:
Motivation, System Configuration with Boundary Scan: TAP Controller and Port, Boundary Scan Test Instructions, Pin Constraints of the Standard, Boundary Scan Description Language: BDSL Description Components, Pin Descriptions.

TEXTBOOKS:

1. M.L. Bushnell, V. D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed Signal VLSI Circuits" 2nd Edition,Kluwer Academic Publishers, 2005**.(UNIT I-V)**

REFERENCES:

1. M. Abramovici, M. A. Breuer and A.D Friedman, "Digital Systems and Testable Design", 1st Edition, Jaico Publishing House, 2002.
2. P.K. Lala, "Digital Circuits Testing and Testability",1st Edition, Academic Press, 1997.

E-REFERENCES

1. Design For Testing
https://en.wikipedia.org/wiki/Design_for_testing

2. Design For Testability
http://www.pld.ttu.ee/~raiub/web_0103/disain_ja_test/SLIDES/1_Introduction.pdf

ELECTIVE-IV	L	T	P	C
	3	-	-	3
19EC8E12: GLOBAL POSITIONING AND NAVIGATION SATELLITE SYSTEMS				

Course outcomes:
Upon completion of this course, the student would be able to

CO1: Describe the concepts of GNSS based positioning methods, the core components of a satellite navigation system and their purposes**.**
CO2: Estimate and represent the GPS coordinate frames and GPS orbits.
CO3: Analyze the impact of various error sources on the precision of positioning.
CO4: Dramatize the examples of their role of goods and services based on the GSP in sustainable development.

UNIT - I
Overview of GPS: Basic concept, system architecture, space segment, user segment, services of GPS, applications of GPS.

UNIT - II
GPS Signals: Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

UNIT - III
GPS coordinate frames, Time references: Geodetic and Geo centric coordinate systems, ECEF coordinate world geodetic 1984 (WGS 84), GPS time.

UNIT - IV
GPS orbits and satellite position determination: GPS orbital parameters, description of receiver independent exchange format (RINEX)–Observation data and navigation message data parameters, GPS position determination.

UNIT - V
GPS Errors: GPS error sources – clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver.

TEXT BOOKS:

1. G. S. RAO, Global Navigation Satellite Systems, 2nd Edition, McGraw-Hill publications, New Delhi, 2010. **(UNIT-I-V)**

REFERENCES:

1. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, 'GPS – Theory and Practice', 4th Edition, Springer – Wien, New York , 2001. (UNIT I-III)
2. Sateesh Gopi, "Global Positioning System: Principles and Applications", 3rd Edition, TMH, 2005. (UNIT I-II)
3. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software Approach', 3rd Edition, John Wiley & Sons, 2001. (UNIT IV-V)
4. Elliot D. Kaplan, "Understanding GPS Principles and Applications", 2nd edition, Artech House, 2005. (UNIT I-III)

E-REFERENCES:

1. http://www.unoosa.org/oosa/sk/ourwork/psa/gnss/gnss.html
2. https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/gps/howitworks/
3. https://www.princeton.edu/~alaink/Orf467F07/GNSS.pdf
4. https://www.euspa.europa.eu/european-space/eu-space-programme/what-gnss
5. https://www.gps.gov/systems/gnss/

ELECTIVE-IV	L	T	P	C
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19CS8E27: INTERNET OF THINGS AND APPLICATIONS				

Course Outcome:

At the end of the course students are able to

1. Explain Arduino IDE tool and Arduino Programming concept.
2. Illustrate concept hardware configuration with Firmata protocols.
3. Explain the knowledge Arduino pin configuration.
4. Differentiate various sensors configuration and workflows.
5. Define architecture of IoT.
6. Explain the knowledge in cloud based web application.

UNIT-I (Introduction to Arduino)

Introduction to Arduino, history of Arduino, variants, Uno board block diagram, installation of Arduino, Arduino IDE, Arduino programming, functions and statements.

UNIT-II (Configuration)

Connecting Arduino borad, introducing the Firmata Protocol, uploading a Firmata sketch to the Arduino board, testing the Firmata protocol.

UNIT-III (Components)

List of components, software flow design, hardware flow design, hardware prototyping software, designing the hardware prototype, Arduino sketch default functions and custom function, setting Arduino board, pin configuration, working with pins.

UNIT-IV (Prototype)

Potentiometer-continuous observation from an analog input connection, Buzzer-generating sound alarm pattern, DC motor-controlling motor speed using PWM, LED- controlling LED brightness using PWM, Servomotor- moving the motor to a certain angle.

UNIT-V (Networking and cloud)

Arduino and computer networking, networking fundamentals, Obtaining the IP address, Networking extensions for Arduino with libraries and class, architecture of IoT web applications, IoT cloud platforms, develop cloud-based IoT applications.

Textbooks:

1. Python programming for Arduino by Pratik desai, Packt Publishing.
2. Internet of Things with Arduino Cookbook by Marco Schwartz.
3. Introduction to Arduino by Alan G. Smith.

References

1. Beginning Arduino by Michael McRoberts, 2e.
2. Getting Started with Arduino Massimo Banzi Second Edition.

ELECTIVE-IV	L	T	P	C
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19EC8L13: VIDEO PROCESSING				

COURSE OUTCOMES:

After the completion of this course, Students will able to
CO1: Explain the characteristics of Video Raster.
CO2: Compare and analyze different types of Spatial Frequency Response and Spatio-temporal Frequency Response**.**
CO3: Describe the characteristics Sampling Video in Two Dimensions.
CO4: Understand the concept of Down-Conversion and Conversion between Arbitrary Lattices, Definition of Two-Dimensional Motion Models .

Unit 1:Video Formation, Perception and Representation

Video Capture and Display Principles of Color Video. Video Cameras. Video Display. Composite versus Component Models. Gamma Conection.Analog Video Raster Progressive vs Interlaced scans. Characterisation of Video Raster. Spatial and Temporal resolution, Signal Bandwidth. Multiplixing of Luminance, Chrominance and Audio.Digital Video Notation. ITU-R.BT.601 Digital Video Format. Other Digital Video Formats and Applications. Digital Video Quality Measure.

Unit 2:Fourier Analysis of Video Signals and Frequency Response of the Human Visual System.

Multidimensional Continuous-Space Signals and Systems.Multidimensional discrete-Space Signals and Systems.Frequency Domain Characterization of Video Signals. Spatial and Temporal Frequencies. Temporal Frequencies Caused by Linear Motion.Frequency Response of the Human Visual System Temporal Frequency Response and Flicker Perception. Spatial Frequency Response. Spatiotemporal Frequency Response. Smooth Pursuit Eye Movement.

Unit 3: Video Sampling

Basics of the Lattice Theory. Sampling of Video Signals Over Lattices Required Sampling Rates. Sampling Video in Two Dimensions: Progressive versus Interlaced Scans. Sampling a Raster Scan: BT.601 Format Revisited. Sampling Video in Three Dimensions. Spatial and Temporal Aliasing. c. Filtering Operations in Cameras and Display Devices Camera Apertures. Display Apertures.

Unit 4:Video Sampling Rate Conversion

Conversion of Signals Sampled on Different Lattices Up-Conversion. Down-Conversion. Conversion between Arbitrary Lattices. Filter Implementation and Design, and other Interpolation Approaches. Sampling Rate Conversion of Video Signals Deinterlacing. Conversion between PAL and NTSC Signals. Motion-Adaptive Interpolation

Unit 5: Video Modeling

Camera Model Pinhole Model. CAHV Model. Camera Motions.Object Model Shape Model. Motion Model.SceneModel.Two-Dimensional Motion Models Definition and Notation. Two-Dimensional Motion Models Corresponding to Typical Camera Motions. Two-Dimensional Motion Corresponding to Three-Dimensional Rigid Motion. Approximation of Projective Mapping.

TEXTBOOKS :

1. J.R.Ohm "Multimedia Communication Technology", 1st edition, Springer Publication, 2003
2. David Bull et al, “"Video Coding for Mobile Communications",1st edition, Academic Press, 2002

REFERENCES:

1. A.I.Bovik, "Handbook on Image and Video Processing",1st edition, Academic Press, 2002.
2. Tekalp "Digital Video Processing",2nd edition, Prentice Hall, 2004.

E-REFERENCES:

1. Video Processing
   https://www.coursera.org/lecture/image-processing/1-what-is-image-and-video-processing-part-1-I5YAF

ELECTIVE-IV	L	T	P	C
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19CS8E28: ARTIFICIAL INTELLIGENCE				

COURSE OUTCOMES:

After undergoing this course, the students will be able to:

1. Build intelligent agents for search and games
2. Solve AI problems through programming with Python
3. Learning optimization and inference algorithms for model learning
4. Design and develop programs for an agent to learn and act in a structured environment.

UNIT I:

Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.

UNIT II:

Search Algorithms: Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.

UNIT III:

Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks-representation, construction and inference, temporal model, hidden Markov model.

UNIT IV:

Markov Decision process: MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

UNIT V:

Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

TEXT BOOKS

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition,Prentice Hall
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill
3. Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House,Delhi.
4. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011

ELECTIVE-V	L	T	P	C
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19EC8E14: DIGITAL DESIGN USING HDL				

COURSE OUTCOMES:

Upon completing this course, the student will be able to

CO1: Describe about fundamental HDL Programming basics and different tools used in developing HDL Programs

.**CO2:** Demonstrate different Programming models for functional circuits.

CO3: Design and develop any digital circuit using both concurrent and Sequential Programming concepts.

CO4: Explain about various Testing techniques used in testing digital circuits.

UNIT - I:Introduction to HDL Languages

History of HDL , Design flow , levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools.Different styles of coding, Language constructs and conventions using lexical tokens.

UNIT - II:Gate Level Modeling:

Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delay, Strengths and Construction Resolution, Net Types, Design of basic Circuit. Design gate level programs developing Dataflow coding with Introduction of Continuous Assignment Structure, Delays and Continuous Assignment**.**

UNIT-III: Behavioral Modeling:

Introduction, Conditional statements, Operations and Assignments ,Functional Bi-furacation, 'Intial' Construct, Assignments with Delays, 'Wait' Construct, Multiple Always Block, Design at Behavioral Level, Blocking and Non-Blocking Assignments, the 'Case' Statement, Simulation Flow, 'If' an 'if-Else' Constructs, The Disable Construct, While Loop, Forever Loop, Parallel Blocks, Force-Release, Construct, Event.

UNIT - IV: Switch Level Modeling:

Basic Transistor Switches, CMOS Switches, Bi-Directional Gates, Time Delays with Switch Primitives, Instantiation with 'Strengths' and 'Delays' Strength Contention with Tri-reg Nets. Path Delays, Module Parameters,System Tasks and Functions, Hierarchical Access,User Defined Primitives.Generation of Test bench for HDL language.

UNIT - V: **Circuit Description and Components Test and Verification:**

Sequential Models, Feedback Model, Basic Memory Components, Functional Register, Static Machine Coding, Introduction to Components Test and Verification, Test Bench - Combinational Circuits Testing, System on Chip, Sequential Circuit Testing, Design Verification,BIST and BILBO techniques.

TEXT BOOKS:

1.Padmanabhan, B Bala Tripura Sundari, "Design Through Verilog HDL", Wiley 2009. **(Unit I-V).**
2. ZainalabdienNavabi, "Verliog Digital System Design",TMH, 2nd Edition, 2006. **(Unit I-V).**

REFERENCES:

1. Samir Palnitkar "Verilog HDL" -, 2nd Edition, Pearson Education, 2009.
2. Michel D. Ciletti "Advanced Digital Design with Verilog HDL" -, PHI,2009.
3. Fundamentals of Digital Logic with Verilog Design - Stephen Brown,ZvonkocVranesic, TMH, 3rd Edition, 2013

E-REFERENCES:

1. Verilog HDL Basics, INTEL
https://www.intel.com/content/www/us/en/programmable/support/training/course/ohdl1120.html
2. Verilog HDL, Tutorialspoint
https://www.tutorialspoint.com/vlsi_design.htm

ELECTIVE-V	L	T	P	C
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19EC8E15: WIRELESS COMMUNICATION				

COURSE OUTCOMES

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

CO1: Describe the functioning of various example wireless communication systems, their evolution and standards.
CO2: Construct on cellular communication system, architecture, functioning,various standards.
CO3: Demonstrate an understanding on signal propagation in cellular environment and an ability explain multiple access techniques for Wireless Communication.
CO4: Evaluate the functioning, protocols, capabilities and application of various wireless communication networks.

UNIT-I

INTRODUCTION: An overview of wireless communication and future vision. Wireless communication system and standards: satellite communication system, GPS, paging system, cordless phone, wireless local loop, RFID.

UNIT-II

THE CELLULAR FUNDAMENTALS: Cellular communication and frequency reuse, general architecture of a cellular system, channel assignment strategies, hand-off in a cellular system. Interference and cellular system capacity: co-channel interference and adjacent channel interference, power control, typical cellular standards (AMPS, GSM, GPRS, WCDMA, LTE, concept of LTE-advanced), 4G features and challenges, 5G vision.

UNIT-III

SIGNAL PROPAGATION IN MOBILE COMMUNICATION: Mobile cellular environment, multipath propagation and fading, free space propagation model, propagation path loss, outdoor propagation models (Okumura model & Hata model), indoor propagation models, power delay profile, channel parameters (delay spread, doppler spread, coherence bandwidth, coherence time, LCR and ADF).

UNIT-IV

WIRELESS COMMUNICATION NETWORKS: Wireless Personal Area Networks (Bluetooth, UWB and ZigBee), Wireless Local Area Networks (IEEE 802.11, network architecture, medium access methods, WLAN standards), Wireless Metropolitan Area Networks (WiMAX), Ad-hoc Wireless Networks.

UNIT-V

MULTIPLE ACCESS SCHEMES: Duplexing schemes, FDMA, TDMA, SDMA, spread spectrum technique and CDMA, OFDMA, ALOHA and CSMA.

TEXT BOOKS:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005. (Unit-I, II, III, IV)
2. William Stallings, Wireless Communication and Networking, PHI, 2003. (Unit I-V)

REFERENCES:

1. Vijay K Garg, "Wireless Communications and Networks", Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian reprint)
2. Sanjay Kumar, "Wireless Communication the Fundamental and Advanced Concepts" River Publishers, Denmark, 2015 (Indian reprint).

E-RESOURCES:

1. www.pdfdrive.com
2. www.booksboon.com
3. www.manybooks.com

ELECTIVE-V	L	T	P	C
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19EC8E16: TELEVISION SYSTEMS AND DESIGN				

COURSE OUTCOMES:

Upon completing this course, the student will be able to
CO1: Demonstrate different analog and digital TV transmitters and receivers.
CO2: Explain the applications of different PDC circuits in TV TX and RX
CO3: Understand different modern television broadcasting systems.
CO4: Design and implementation of different types of digital display systems for TV.

UNIT- I:
TV TRANSMITTER AND RECEIVER:
TV Transmitters, Synchronization, Geometric form and Aspect Ratio, Image Continuity, Interlaced Scanning, Number of Scanning Lines, Picture Resolution,Composite Video Signal, TV Standards, Standard Channel BW and Monochrome TV Receiver.

UNIT- II:
CAMERA TUBES:
Image Orthicon Plumbicon, Vidicon, Silicon Diode Array Vidicon, Comparison of Camera Tubes Monochrome TV ,Colour TV Transmission and Reception, Compatibility,Colour Perception, Three Colour theory- Luminance, Hue and Saturation, PAL, NTSC, SECAM, World Standards.

UNIT- III:
SYNC SEPARATION AND DETECTION:
Video Amplifier, Sound Section, Sync Separation and Processing, Deflection Circuits, Scanning Circuits, Deflection Oscillators, Synchronous Separation, k Noise in Sync Pulses, Separation of Frame and Line Sync Pulses, AFC, Single Ended AFC Circuit, Deflection Oscillators, Deflection Drive IO's.

UNIT-IV:
DIGITAL TELEVISION:
Advance Digital Television Systems, CCIR Standard of Digital TV Studio, and Digital Studio Equipments, Compression, 3D TV, LCD TV, HDTV, Flat Panel Display TV, LED TV, OLED TV, Plasma Screen TV, New Era Projection TV.

UNIT-V:
DIGITAL BROADCASTING STANDARDS AND SYSTEMS:
DAB, CCTV, DVB-S, DVB- C, DVB-T, HD Radio, DTH and Satellite Television.

TEXT BOOKS:

1. A.M.Dhake, “Television and Video Engineering”,2nd Edition, TMH, 2003. **(UNIT I,II,III)**
2. R .R.Gallatin, “Modern Television Practice Principles, Technology and Service”, New Age International Publication, 2002**. (UNIT IV V)**

REFERENCES:

1. S.P.BaI, “Colour Television Theory and Practice”, TMH, 1994.
2. B.Grob and C.E.Herndon, “Basic Television and Video Systems”, McGraw Hill, 1999.
3. R.R. Gulati, “Monochrome and Colour TV”, New Age International Publication, 2002.

E REFERENCES:

1. https://www.youtube.com/watch?v=lMVJNDs2ptU
2. https://lecturenotes.in/subject/605/television-and-video-engineering

ELECTIVE-V	L	T	P	C
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19EC8E17: PATTERN RECOGNITION				

COURSE OUTCOMES:

Upon completion of the course, students are able to:
CO1: Describe about supervised and unsupervised pattern classifiers.
CO2: Extract feature set and select the features from given data set.
CO3: Classify the data and identify the pattern Recognition models.
CO4: Apply fuzzy logic and genetic algorithms for classification problems.

UNIT I: Introduction

Design principles of pattern recognition system , Learning and adaptation , Pattern recognition approaches, Mathematical foundations: Linear algebra – Probability theory – Expectation – Mean and Covariance – Normal distribution – Multivariate normal densities – Chi square test of hypothesis. Supervised learning, Parametric estimation,

UNIT II: Clustering

Clustering for unsupervised learning and classification, Clustering concept , C Means algorithm , Hierarchical clustering , Graph theoretic approach to pattern Clustering , Validity of Clusters.

UNIT III: Statistical Pattern Recognition

Statistical Patten Recognition: Bayesian Decision Theory, Classifiers – Normal density and discriminant functions, Pattern classification by distance functions, Minimum distance classifier.

UNIT IV: Models

Parameter estimation methods: Maximum-Likelihood estimation , Bayesian Parameter estimation, Dimension reduction methods, Principal Component Analysis (PCA), Fisher Linear discriminant analysis , Expectation-maximization (EM), Hidden Markov Models (HMM) , Gaussian mixture models.

UNIT V: Recent Advances

Fuzzy logic, Fuzzy Pattern Classifiers, Pattern Classification using Genetic Algorithms, Case Study Using Fuzzy Pattern Classifiers and Perception.

TEXT BOOK:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", Second Edition, John Wiley, 2006. **(UNIT I,II,III,IV,V)**
2. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press. 2009.**(UNIT I,II,III)**

REFERENCES:

1. M. Narasimha Murthy and V. Susheela Devi, "Pattern Recognition", Springer 2011.
2. Menahem Friedman , Abraham Kandel, "Introduction to Pattern Recognition Statistical, Structural, Neural and Fuzzy Logic Approaches", World Scientific publishing Co. Ltd, 2000
3. Robert J.Schalkoff, "Pattern Recognition Statistical, Structural and Neural Approaches", John Wiley & Sons Inc., New York, 1992.
4. Bishop, Christopher M., "Pattern Recognition and Machine Learning", First Edition, Springer, 2010.

E-REFERENCES

1. https://www.cet.edu.in/noticefiles/273_PATTERN%20RECOGNITION.pdf
2. https://nptel.ac.in/courses/117/105/117105101/
3. https://www.ktuassist.in/2020/03/ktu-ec467-patternrecognition-study.html

ELECTIVE-V	L	T	P	C
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19CS8E25: MACHINE LEARNING				

Course outcomes:

At the end of the course students are able to

1. Define basic concepts of machine learning.
2. Evaluate and compare the performance or, other qualities of regression and logistic regression.
3. Describe concepts of artificial intelligence.
4. Design a supervised or unsupervised learning system.
5. Define the knowledge about SVM.
6. Demonstrate Instance based learning algorithms.

UNIT I: Introduction

Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning. Concept learning and the general to specific ordering – Introduction, a concept learning task, Concept learning as search, Find- S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.

UNIT II: Linear Regression & Logistic Regression

Predicting numeric values: regression – Finding the best fit lines with linear regression, locally weighted linear regression, Shrinking Coefficients, The bias / Variance tradeoff. Logistic Regression: Classification with logistic regression and the sigmoid function, using optimization to find the best regression coefficients.

UNIT III: Artificial Neural Networks

Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition, Advanced topics in artificial neural networks.

UNIT IV: Evaluation Hypotheses

Motivation, Estimation hypothesis accuracy, Basics of sampling theory, a general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms.

UNIT V: Support vector machines & Dimensionality Reduction techniques

Separating data with the maximum margin, finding the maximum margin, efficient optimization with SMO algorithm, speeding up optimization with full platt SMO, Using Kernels for more Complex data. Dimensionality Reduction techniques: Principal Component analysis, Example.

Instance-Based Learning

Introduction, k -Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

TEXT BOOKS

1. Machine Learning, Tom M. Mitchell, MGH
2. Machine Learning in Action, Peter Harington, 2012, Cengage.`

REFERENCE BOOKS

Introduction to Machine Learning, Ethem Alpaydin, PHI, 2004

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OPEN ELECTIVE	**3**	**-**	**-**	**3**
19EEXO01 :: ELECTRICAL SAFETY MANAGEMENT				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Explain the Electrical Safety precautions and Prevention. (K2)
CO2 : Illustrate Safety aspects during Installation of Plant and Equipment. (K2)
CO3 : Estimate the electrical safety in residential, commercial and agricultural installations.(K5)
CO4 : Categorize various Electrical Safety in Hazardous Areas (K4)
CO5 : List the electrical systems safety management and IE rules.(K1)

SYLLABUS

UNIT-I : ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION

Terms and definitions, objectives of safety and security measures, Hazards associated with electric current, and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety.

Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

UNIT-II : SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT

Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switch yard equipment, safety during installation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

UNIT-III : ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS

Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

UNIT-IV : ELECTRICAL SAFETY IN HAZARDOUS AREAS

Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipments for hazardous locations – Classification of equipment enclosure for various hazardous gases and vapours – classification of equipment/enclosure for hazardous locations.

EQUIPMENT EARTHING AND SYSTEM NEUTRAL EARTHING: Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, , neutral grounding(System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.

UNIT-V : SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS

Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees.

REVIEW OF IE RULES AND ACTS AND THEIR SIGNIFICANCE: Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and fire fighting facility. The Electricity Act, 2003, (Part1, 2, 3,4 & 5)

TEXT BOOKS:

1 S. Rao, Prof. H.L. Saluja, "Electrical safety, fire safety Engineering and safety management", Khanna Publishers. New Delhi, 1988.(units-I to V)

2 www.apeasternpower.com/downloads/elecact2003.pdf (Part of unit-V)

REFERENCE BOOKS:

1 Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.

2. The Electricity Act, 2003 MINISTRY OF LAW AND JUSTICE (Legislative Department) New Delhi, the 2nd June, 2003.Jyaistha 12, 1925 (Saka)

OPEN ELECTIVE	L	T	P	C
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19EEXO02 :: NON CONVENTIONAL ENERGY SOURCES				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Show the need of energy conversion and the analysis of solar radiation. (K1)
CO2 : Analyze solar radiation data, extraterrestrial radiation, radiation on earth's surface and solar thermal systems. (K4)
CO3 : Identify the methods and analysis of Wind energy generation and its maximum power point techniques. (K3)
CO4 : Explain basic principle and working of hydro and tidal energy systems. (K2)
CO5 : Explain the Biomass, Fuel cells and Geothermal energy, its mechanism of production and its applications (K2)

SYLLABUS

UNIT-I : FUNDAMENTALS OF ENERGY SYSTEMS:

Energy conservation principle – Energy scenario (world and India) – Solar radiation: Outside earth's atmosphere – Earth surface – Analysis of solar radiation data – Geometry – Radiation on tilted surfaces – Numerical problems.

UNIT-II : SOLAR THERMAL SYSTEMS

Liquid flat plate collections: Performance analysis –Introduction to solar air heaters – Concentrating collectors and solar pond– Numerical problems.

Solar Photovoltaic Systems : Solar Photovoltaic cell, Module,Array – Construction– Efficiency of solar cells – Developing technologies – Cell I-V characteristics – Applications and systems – Maximum power point tracking.

UNIT-III : WIND ENERGY

Sources of wind energy – Wind patterns – Types of turbines – Horizontal axis and vertical axis machines – Kinetic energy of wind – Betz coefficient – Tip–speed ratio – Efficiency – Power output of wind turbine – Selection of generator(synchronous, induction) – Maximum power point tracking.

UNIT-IV : HYDRO AND TIDAL POWER SYSTEMS

Basic working principle – Classification of hydro systems: Large, small, micro – measurement of head and flow – Energy equation – Types of turbines – Numerical problems. Tidal power – Basics – Kinetic energy equation – Numerical problems – Wave power – Basics – Kinetic energy equation.

UNIT-V : BIOMASS, FUEL CELLS AND GEOTHERMAL SYSTEMS

Biomass Energy: Fuel classification – Pyrolysis – Direct combustion of heat – Different digesters and sizing. Fuel cell: Classification of fuel for fuel cell – Fuel cell voltage – Efficiency – VI characteristics. Geothermal: Classification – Dry rock and hot acquifer – Energy analysis.

TEXT BOOKS:

1 Renewable Energy Resoures, John Twidell and Tony Weir, Taylor and Francis -second edition, 2013
2 Non conventional sources of Energy by G.D.Rai, Kanna Publications.
3 Renewable Energy Technologies /Ramesh & Kumar /Narosa.

REFERENCE BOOKS:

1 Energy Science: Principles, Technologies and Impacts, John Andrews and Nick Jelly, Oxford University Press, 2017**.**
2 Renewable Energy- Edited by Godfrey Boyle-oxford university, press, 3rd edition, 2013.
3 Handbook of renewable technology Ahmed and Zobaa, Ramesh C Bansal, World scientific, Singapore
4 Renewable energy technologies – A practical guide for beginners – Chetong Singh Solanki, PHI.
5 Non conventional energy source –B.H. Khan- TMH-2nd edition
6 Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, TMH, New Delhi, 3rd Edition

OPEN ELECTIVE	L	T	P	C
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19EEXO03::ELECTRICAL VEHICLE				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Explain the basics of electric vehicles fundamentals.(K2)
CO2 : Discuss different energy storage concepts used for electric vehicles.(K6)
CO3 : Explain about fundamental of electrical Machines .(K2)
CO4 : Analyze various drive trains suitable for electric vehicles .(K4)
CO5 : Explain about different types of EV Systems.(K2)

SYLLABUS

UNIT-I : INTRODUCTION TO ELECTRIC VEHICLES

Components of an EV ,EV History, EV Advantages ,EV mechanics , Roadway Fundamentals , Laws of Motion , Vehicle Kinetics , Dynamics of Vehicle Motion , Propulsion Power, Velocity and Acceleration, Propulsion System Design

UNIT-II : BATTERY

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Lead-Acid Battery, Alternative Batteries, Battery Parameters, Technical Characteristics, Targets and Properties of Batteries , Battery Modeling

UNIT-III : DC & AC ELECTRICAL MACHINES

Motor and Engine rating, Requirements, Fundamental concepts of DC machines- Three phase A/c machines- Induction machines- permanent magnet machines-switched reluctance machines

UNIT-IV : ELECTRIC VEHICLE DRIVE TRAIN

EV Transmission Configurations , Transmission Components, Ideal Gearbox, EV Motor Sizing

UNIT-V : HYBRID ELECTRIC VEHICLES

Types of Hybrids, Internal Combustion Engines , Design of an HEV ,Drive train, sizing of components.

TEXT BOOKS:

1 Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.

REFERENCE BOOKS:

1 James Larminie and John Lowry,“Electric Vehicle Technology Explained”, Wiley, 2003.

2 Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay and Ali Emadi, ““Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals”, CRC Press, 2010.

3 Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.

4 Introduction to hybrid and electric vehicles: Dr Praveen Kumar & Dr S Majhi, IIT Guwahati , https://nptel.ac.in/courses/108/103/108103009/ .

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19EEXO04:: ELECTRICAL ENERGY CONSERVATION AND AUDITING				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Explain energy efficiency, conservation and various technologies [K2]
CO2 : Identify the concepts of energy management and energy audit [K3]
CO3 : Explain energy conservation in HVAC systems.[K2]
CO4 : Analyze the concepts of different energy efficient devices [K4]
CO5 : Estimate life cycle costing analysis and energy efficient Technologies [K5]

SYLLABUS

UNIT-I : BASICS OF ENERGY AND ITS VARIOUS FORMS

Energy consumption –choice of fuels. Energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity and humidity & heat transfer, units and conversion.

UNIT-II : ENERGY MANAGEMENT & AUDIT

Energy conservation schemes: Short term - Medium term - Long term energy conservation schemes – Industrial energy use - Energy index – Cost index. Representation of energy consumption: Pie charts - Sankey diagrams – Load Profile.
Energy auditing: General Auditing, Detailed Energy Audit. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

UNIT-III : ENERGY EFFICIENCY IN INDUSTRIAL & ELECTRICAL SYSTEMS

Heat – Heat content – Rate of heat transfer – Heat transfer coefficient - Conduction – Convention and radiation. Thermal insulation & its importance - space heating – HVAC system – Heating of Buildings. Energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

UNIT-IV : ENERGY EFFICIENT INSTRUMENTS

Digital Energy Meter – Data loggers – Thermo couples – Pyranometer – Lux meters – Tong testers – Power analyzers – Power factor – effects with non-linear loads – effect of harmonics on power factor – Power Factor Improvement – Capacitor rating - Effects of power factor improvements - Electric lighting – Types of lighting – Luminaries – Energy efficient lighting.

UNIT-V : ECONOMICAL ASPECTS & FINANCIAL ANALYSIS

Costing Techniques – cost factors – break-even charts – sources of capital and hire charges -capital recovery – depreciation – budgeting and standard costing – charging energy – cash flow
diagrams and activity charts. Financial appraisal and profitability : investment decision- methods of investment appraisal discounted cash flow – summary of investment appraisal techniques – Cost optimization – optimization with one variable – optimization with more than one variable.

TEXT BOOKS:

1 Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications.
2 Hand Book of Energy Audit by Sonal Desai- Tata McGraw hill
3 Energy management hand book by W.C.Turner, John wiley and sons.
4 Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.
5 Economic Analysis of Demand Side Programs and Projects - California Standard Practise Manual, June 2002 – Free download available online
6 Energy Efficiency And Management For Engineers, November 2020, TMH, by Mehmet Kanoglu , Yunus A. Cengel

REFERENCE BOOKS:

1 Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1st edition,1998.
2 Energy management and conservation –k v Sharma and pvenkataseshaiah-I K International Publishing House pvt.ltd,2011
3 Fundamentals of Energy Engineering by Albert Thumann, Prentice Hall Inc, Englewood Cliffs, New Jersey, 1984.
4 Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)
5 Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)

OPEN ELECTIVE	L	T	P	C
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19CEXO01: DISASTER MANAGEMENT				

Course Outcomes:

Students are able to

1. identify the tools of integrating disaster management principles in disaster mitigation process.
2. discuss about different approaches needed to manage pre and post- disaster activities**.**
3. prepare the process of risk management and develop a basic understanding method for the role of public in risk management.
4. administer the role of technology in Disaster management.
5. conclude the planning strategies for education and community preparedness programmes.

UNIT-I : Natural Hazards and Disaster management:

Introduction of DM – Inter disciplinary nature of the subject- Disaster Management cycle- Five priorities for action. Case study methods of the following: floods, draughts -Earthquakes- global warming, cyclones & Tsunamis- Post Tsunami hazards along the Indian coast - landslides.

UNIT-II: **Man Made Disaster and their management along with case study methods of the following**:

Fire hazards - transport hazard dynamics -Solid waste management- post disaster – Bio terrotirism -threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.

UNIT-III: **Risk and Vulnerability**:

Building codes and land use planning - social vulnerability - environmental vulnerability - Macroeconomic management and sustainable development, climate change risk rendition - financial management of disaster - related losses.

UNIT-IV: **Role of Technology in Disaster managements**:

Disaster management for infra structures, taxonomy of infrastructure - treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earth quakes -flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training transformable indigenous knowledge in disaster reduction.

UNIT-V: **Education and Community Preparedness**

Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building community capacity for action.

Textbooks:

1. Rajib shah & R. Krishnamurthy, 'Disaster Management - Global Challenges and Local Solutions' Universities press-2009.

2. Tushar Bhattacharya, 'Disaster Science & Management', Tata McGraw Hill Education Pvt. Ltd., New Delhi.-2012

3. Jagbir Singh , 'Disaster Management - Future Challenges and Opportunities' , I K International Publishing House Pvt. Ltd-2017

References:

1**.** H K Gupta , **'**Disaster Management', Universities press-2003

2**.** Prof. R.B. Singh , "Disaster Management and Mitigation", World Focus 2016

OPEN ELECTIVE	L	T	P	C
	3	-	-	3
19CEXO02: ENVIRONMENTAL POLLUTION AND CONTROL				

Course Outcomes:

Students are able to

1. Identify the air pollutant causes and control devices
2. Differentiate the treatment techniques used for sewage and industrial wastewater treatment methods.
3. Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city.
4. know the causes for noise pollution and ISO14000 standards
5. Treatment and management of hazardous waste

SYLLUBUS

UNIT – I : Air Pollution

Air pollution causes-control methods–particulate control devices – methods of controlling Gaseous Emissions – Air quality standards.

UNIT –II: Industrial wastewater Management

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

UNIT – III : Solid Waste Management

Solid waste characteristics–basics of on-site handling and collection–separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of land filling.

UNIT – IV: Noise Pollution

Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000

UNIT – V: Hazardous Waste

Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

Text/References books:

1. Ruth F. Weiner and Robin Matthews , 'Environmental Engineering', 4th Edition Elesevier, 2003.
2. J.G. Henry and G.W. Heinke,'Environmental Science and Engineering'– Pearson Education,2002
3. Mackenzie L Davis & David A Cornwell, "Environmental Engineering ',McGraw Hill Publishing,2002.
4. K. Sasi Kumar, S.A. Gopi Krishna ,"Solid Waste Management",PHI New Delhi,2014
5. D. Srinivasan, "Environmental Engineering", PHI Learning Private Limited, New Delhi, 2011.
6. Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus,"Environmental Engineering", Mc-Graw-Hill Book Company, New Delhi, 1985.

OPEN ELECTIVE	L	T	P	C
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19CEXO03: SOLID WASTE MANAGEMENT				

Course Outcomes:

Students are able to

1. Understand classification of solid waste generated
2. know the collection systems of solid waste of a town
3. analyze the importance of transfer and transport of solid waste
4. apply the knowledge in processing of solid waste
5. design treatment of municipal solid waste and landfill

SYLLUBUS:

UNIT- I

Introduction to Solid Waste Management:

Goals and objectives of solid waste management, Classification of Solid Waste - Factors Influencing generation of solid waste - sampling and characterization – Future changes in waste composition, major legislation, monitoring responsibilities.

UNIT- II

Collection of Solid Waste:

Type and methods of waste collection systems, analysis of collection system - optimization of collection routes– alternative techniques for collection system.

UNIT- III

Transfer and Transport:

Need for transfer operation, compaction of solid waste - transport means and methods, transfer station types and design requirements.

UNIT- IV

Processing and Treatment:

Processing of solid waste – Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators.

UNIT- V

Disposal of Solid Waste:

Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation.

Text/ Reference books:

1. George Techobanoglous, Frank Kreith ,Integrated Solid Waste Management- McGraw Hill Publication, 1993.
2. R.Saravanan, R.Dinesh Kumar, A.Suriya , Muncipal solid waste management , Lakshmi publications- 2015.
3. Vesilind, P.A., Worrell, W., Reinhart, D.,“Solid Waste Engineering”, Cenage learning, New Delhi, 2004.
4. Charles A. Wentz, “Hazardous Waste Management”,; McGraw Hill Publication, 1995.

OPEN ELECTIVE	L	T	P	C
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19CEXO04: BUILDING PLANNING AND DRAWING				

COURSE OUTCOMES

Students are able to

1. Understand the building bye-laws, plan various buildings as per the building by-laws.
2. Plan the individual rooms with reference to functional and furniture requirements.
3. prepare different sign conventions and bonds
4. Learn the skills of drawing building elements like doors and windows.
5. Develop the skills of Drawing Plans, Sections and Elevations of different buildings.

SYLLABUS:

UNIT-I

BUILDING BYELAWS AND REGULATIONS: Introduction - terminology - objectives of building Bye laws - floor area ratio - floor space index - principles under laying building bye laws - classification of buildings - open space requirements - built up area limitations- height of buildings- wall thickness - lightening and ventilation requirements.

UNIT -II

RESIDENTIAL AND PUBLIC BUILDINGS

Residential buildings: Minimum standards for various parts of buildings -requirements of different rooms and their grouping- characteristics of various types residential buildings.

Public buildings: Planning of educational institutions, hospitals, dispensaries, office buildings, banks, industrial buildings, hotels & motels, buildings for recreation.

UNIT-III

SIGN CONVENTIONS AND BONDS : Brick, stone, plaster, sand filling, concrete, glass, steel, cast iron, copper alloys, aluminum alloys etc., lead, zinc, tin etc., earth, rock, timber and marbles. English bond and Flemish bond- odd and even courses for one, one-half, two and two & half brick walls in thickness at the junction of a corner.

UNIT- IV

DOORS, WINDOWS, VENTILATORS AND ROOFS: Panelled door, panelled and glassed door, glassed windows, paneled windows, swing ventilators, fixed ventilators, coupled roof, collar roofs. King Post truss, Queen Post truss Sloped and flat roof buildings: drawing plans, Elevations and Cross Sections of given sloped roof buildings.

UNIT-V

PLANNING AND DESIGNING OF BUILDINGS: Draw the Plan, Elevation and sections of a Residential & Public buildings from the given line diagram.

Text /Reference Books:

1. Y.S. Sane., Planning and Design of buildings, 2010.
2. Gurucharan Singh and Jagadish Singh , Planning, designing and scheduling, 2015.
3. M. Chakravarthi., Building planning and drawing, 2015.
4. ‘A’ Series & ‘B’ Series of JNTU Engineering College, Anantapur.
5. Shah and Kale , Building drawing, 2013.

OPEN ELECTIVE	L	T	P	C
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19MEXO01: 3D PRINTING				

COURSE OBJECTIVES:

- To explore technology used in additive manufacturing
- To acquire knowledge for selecting correct CAD formats in manufacturing process.
- To understand the operating principles and limitations of liquid, solid and laser based additive manufacturing system.
- To understand the operating principles and limitations of laser based additive manufacturing system.
- To acquire knowledge on important process parameters for bio-manufacturing

COURSE OUTCOMES: Students are able to

CO1: Explain the fundamentals of Additive Manufacturing Technologies for engineering applications. **[K2]**

CO2: Select and use correct CAD formats in the manufacture of a 3D printed part **[K2**]

CO3: Describe the operating principles, capabilities, and limitations of liquid and solid based additive manufacturing system, including fused deposition modeling and stereo lithography [**K2]**

CO4: Describe the operating principles, capabilities and limitations of laser based additive manufacturing system. **[K2**]

CO5: Describe the important process parameters for bio-manufacturing and determine the suitable additive technique for bio-manufacturing, aerospace and manufacturing engineering. **[K2]**

UNIT I

INTRODUCTION

Overview, History, Need, Classification, Additive Manufacturing Technology in product development - Materials for Additive Manufacturing Technology

UNIT II
REVERSE ENGINEERING

Basic Concept –3D Scanning Digitization techniques , Model Reconstruction, Data Processing for Additive Manufacturing Technology, Part Orientation and support generation, Model Slicing, Tool path Generation.

UNIT III
LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS

Classification, Stereo lithography Apparatus (SLA) - Principle, Process, advantages, Fused Deposition Modeling – principle, process, advantages.

UNIT IV

LASER BASED ADDITIVE MANUFACTURING SYSTEMS
Selective Laser Sintering - Principle, Process, advantages, Three Dimensional Printing – Principle, process, advantages, Laser Engineered Net Shaping (LENS).

UNIT V

APPLICATIONS OF 3D PRINTING

Customized implants and prosthesis: Design and development, Bio-Additive Manufacturing, Computer Aided Tissue Engineering (CATE), Applications of 3D Printing in Aerospace, Automotive, Manufacturing and Architectural Engineering.

TEXT BOOKS

1. Chua C.K., Leong K.F., and Lim C.S., Rapid prototyping: Principles and applications, Third Edition, World Scientific Publishers, 2016.

2**.** Gebhardt A,Rapid prototyping, Hanser Gardener Publications, 2017.

3. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications, World Scientific Publishers, Fourth Edition of Rapid Prototyping, 2016.

REFERENCES

1. Liou L.W. and Liou F.W., Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press, 2017.

2. Kamrani A.K. and Nasr E.A., Rapid Prototyping: Theory and practice, Springer, 2016.

3. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2015.

OPEN ELECTIVE	L	T	P	C
	3	-	-	3
19MEXO02 - FARM MACHINERY				

COURSE OBJECTIVES:

- To impart the students to understand the fundamentals of machinery in farming.
- To enable the students to acquire knowledge on tillage and equipment used.
- To introduce the students about various types of earth moving equipment.
- To enable the students to acquire knowledge on seeding and spraying equipment.
- To introduce the fundamentals of transplanting machinery and fertilizer equipment.

COURSE OUTCOMES: Students will be able to

CO1. Explain various types of machinery in farming. [K2]
CO2. Illustrate different types of farm operation for craft cultivation with scientific understanding. [K2]
CO3. Explain various types of earth moving equipment. [K2]
CO4. Summarize various seeding methods and sprayer types. [K2]
CO5. Explain transplanting methods and fertilizer equipment. [K2]

UNIT I

Farm Mechanization: Objectives of Farm Mechanization, sources of farm power, classification of farm machines. Materials of construction and heat treatment. Principles of operation and selection of machines used for production of crops - Field capacities of different implements and their economics. Problems on field capacities and cost of cultivation

UNIT II

Tillage and Equipment: Classification and types of tillage, Primary tillage implements-Mould board plough and its parts, Disc plough, and other ploughs, Secondary tillage equipment- Disc harrows, implements- Cultivators, and intercultural implements. Forces acting on tillage tools, Problems on forces analysis, Draft measurement of tillage equipment, Draft and unit draft related problems.

UNIT III

Earth Moving Equipment: Earth moving equipment-terminology, Earth moving equipment, construction and their working principles, Earth moving equipment- shovels, Bulldozers, Earth moving equipment- Trenches and elevators.

UNIT IV

Seed Drills and Sprayer:

Seeding methods, Different types of seed metering mechanism, different types of furrow openers. Calibration of Seed drills. Adjustment of Seed Drills - Objectives and uses of plant protection equipment. Types of sprayers and dusters. Sprayer calibration and selection. Constructional features of different components of sprayers and dusters and their adjustments.

UNIT V

Transplanting and Fertilizer: Transplanting methods, different types of Transplanting machinery and their working principle,adjustments in Transplanting equipment. Fertilizer application equipment – fertilizer meeting mechanism calibration of fertilizer equipment.

TEXTBOOKS

1. Triveni Prasad Singh, Farm Machinery. India, Prentice Hall India Pvt., Limited, 2016.
2. Jagadeshwar Sahay, Elements of Agricultural Engineering, Agro Book agency, Patna, 1992.
3. Borshahov Mansurov Sergecy, Land Reclamation Machinery, Mir Publishers, Moscow,1988.
4. Kepner R A, Bainer R and Barger E L, Principles of Farm Machinery, CBS Publishers and Distrubutors, New Delhi, 1987.
5. Michael A M and Ojha T P, Principles of Agricultural Engineering, Jain Brothers, New Delhi, 1985, Vol.I.
6. Smith H P, Farm Machinery and Equipment, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1971.
7. Stone A A, Farm Machinery, John Wiley & Sons, New York.

REFERENCES

1. Srivastaba A.C, Elements of Farm Machinery, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi, 1990.
2. Krutz, Gary, Thompson Lester and Claar, Paul, Design of Agricultural Machinery", John Wiley and Sons, 1984.
3. Lal, Radhey and Dutta, A.C. Agricultural Engineering through solved examples, Saroj Prakashan Publishers, Allahabad, 1971

OPEN ELECTIVE	L	T	P	C
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19MEXO03 - BIO-MECHANICAL ENGINEERING				

COURSE OBJECTIVES:

The student should be made to:

- Explain the principles of mechanics.
- Discuss the mechanics of musculoskeletal system.
- Explain the linear kinetics and angular kinetics
- Illustrate the mathematical models used in the analysis of biomechanical systems

COURSE OUTCOMES: Students are able to

CO1 Infer the introduction of Bio mechanics. [K4]
CO2 Learn about mechanics of musculoskeletal system. [K2]
CO3 Relate the concept of kinetics with human motion. [K3]
CO4 Develop knowledge on mechanical analysis of human motion. [K3]
CO5 Analyze human movements. [K4]

UNIT-I

INTRODUCTION TO BIO MECHANICS

Principles of mechanics in human movement, Qualitative and quantitative Analysis, Key mechanical concepts of mechanics and basic units, Nine fundamentals of biomechanics, Nine principles for application of Biomechanics.

UNIT-II

MECHANICS OF MUSCULOSKELETAL SYSTEM

Principles of joint motions, Muscle structures, Mechanical method of muscle action analysis, Tissue loads and forces, Biomechanics of bones and ligaments, Three mechanical characters of muscle, SSC.

UNIT-III

LINEAR KINETICS AND ANGULAR KINETICS

Vector analysis of angle of pull and muscle angle pull, Contact forces, Impulse-Momentum Relationship, Force-Time Principle, Work-Energy relationship, Segmental interaction principle, Torque, Equilibrium, Center of gravity and Principle of balance.

UNIT-IV

MECHANICAL ANALYSIS OF HUMAN MOTION

Linear kinematics - linear kinematic analysis, position and displacement, velocity and speed, acceleration, differentiation and integration, kinematics of running, kinematics of projectiles, equations of constant acceleration. Angular kinematics - angular motion, measurements of angles, types of angles, representation of angular motion vectors, lower extremity joint angles, relationship between angular and linear motion, angular kinematics of running.

UNIT-V

APPLICATIONS OF ENGINEERING EDUCATION & MEDICAL REHABITATION

Qualitative analysis of Kicking technique, batting, catching, throwing techniques, Injury risk assessment, Equipment design for strength training, Injury mechanics, Injury prevention.

TEXT BOOKS:

1. Ronald L.Huston, Principles of Biomechanics,1st edition CRC Press, 2019
2. Joseph E.Muscolino, " Kinesology", 3rd edition, Mosby, 2016.
3. Subrata Pal, "Textbook of Biomechanics", 1st edition, Springer US, 2016.

REFERENCE BOOKS:

1. Duane Knudson, "Fundamentals of Biomechanics", 2nd edition, Springer, 2013.
2. Ajay Bahl, "Basics of Biomechanics", 1st edition, Jaypee Brothers Medical Publishers, 2010.
3. Robert frost, "Applied Kinesiology", 1st edition, North Atlantic Books; 2013
4. David A. Winter, "Biomechanics and Motor Control of Human Movement", John Wiley & sons,Inc., 2009.

OPEN ELECTIVE	L	T	P	C
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19MEXO04- WASTE TO ENERGY CONVERSION				

COURSE OBJECTIVES:

- To enable students to understand of the concept of Waste to Energy.
- To link legal, technical and management principles for production of energy form waste.
- To learn about the best available technologies for waste to energy.
- To facilitate the students in developing skills in the decision making process.

COURSE OUTCOMES: Students will be able to

CO1. Describe of the concept of Waste to Energy, classifications and principles.[K2]
CO2. Explain the Technical and management principles for production of energy form waste.[K2]
CO3. Explain the best available technologies for waste to energy.[K2]
CO4. Describe the Waste to Energy Options Landfill gas, RDF,AFR andenergy from Plastics.[K2]
CO5. Apply the knowledge in planning and operations of Waste to Energy plants[K3]

UNIT-I

Introduction: Principles of Waste Management and Waste Utilization, Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle, Waste as a Resource and Alternate Energy source.

UNIT-2

Waste Sources & Characterization: Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous), Characterization of waste for energy utilization, Waste selection criteria.

UNIT- 3

Technologies for Waste:Energy Biochemical Conversion – energy production from organic waste through anaerobic digestion and fermentation, Thermo-chemical Conversion – combustion, incineration, heat recovery, pyrolysis, gasification, Plasma Arc Technology, other newer technologies.

UNIT- 4

Waste to Energy Options: Landfill gas, collection and recovery, Refuse Derived Fuel (RDF) – fluff, briquettes, pellets, Alternate Fuel Resource (AFR) – production and use in cement plants, thermal power plants, Industrial boilers, Conversion of wastes to fuel resources for other useful energy applications, Energy from Plastic Wastes – non-recyclable plastic wastes for energy recovery, Energy recovery from wastes and optimization of its use, benchmarking and standardization, Energy Analysis.

UNIT-5:

Waste to Energy Plants

Waste management activities – collection, segregation, transportation and storage requirements, Location and Siting of 'Waste to Energy' plants, Industry Specific Applications – In-house use

Waste to Energy & Environmental Implications: Environmental standards for Waste to Energy Plant operations and gas clean-up. Savings on non-renewable fuel resources, Carbon Credits- carbon foot calculations, carbon credits transfer mechanisms.

TEXT BOOKS:

1. B.T. Nijaguna, Biogas Technology, 1st Edition, New Age International Pvt Ltd, 2002.

2. Marc Rogoff Francois Screve, Waste-to-Energy, 3rd Edition, William Andrew,2019.
3. Vishal Prasad, BarkhaVaish, Advances in Waste-to-Energy Technologies, 1stEdition, CRC Press, 2019
4. Dev Vrat Kamboj, Manoj Kumar Solanki, Waste to Energy: Prospects and Applications, 1st Edition, Springer,2021

REFERENCE BOOKS:

1. Khandelwal, K. C. and Mahdi.S.S, Biogas Technology - A Practical Hand Book, 1st Edition, 1986.
2. Challal,D.S, Food Feed and Fuel from Biomass, 1st Edition, IBH Publishing Co. Pvt. Ltd, 1991.
3. C. Y. WereKo-Brobby and E. B. Hagan, Biomass Conversion and Technology, 1st Edition, John Wiley& Sons, 1996.Desai, Ashok V, Non-Conventional Energy, 1st Edition, Wiley Eastern Ltd, 1990

OPEN ELECTIVE	L	T	P	C
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19CSXO01 - INTERNET OF THINGS AND APPLICATIONS				

Course Outcome:

At the end of the course students are able to

1. Explain Arduino IDE tool and Arduino Programming concept.
2. Illustrate concept hardware configuration with Firmata protocols.
3. Explain the knowledge Arduino pin configuration.
4. Differentiate various sensors configuration and workflows.
5. Define architecture of IoT.
6. Explain the knowledge in cloud based web application.

UNIT-I (Introduction to Arduino)
Introduction to Arduino, history of Arduino, variants, Uno board block diagram, installation of Arduino, Arduino IDE, Arduino programming, functions and statements.

UNIT-II (Configuration)
Connecting Arduino borad, introducing the Firmata Protocol, uploading a Firmata sketch to the Arduino board, testing the Firmata protocol.

UNIT-III (Components)
List of components, software flow design, hardware flow design, hardware prototyping software, designing the hardware prototype, Arduino sketch default functions and custom function, setting Arduino board, pin configuration, working with pins.

UNIT-IV (Prototype)
Potentiometer-continuous observation from an analog input connection, Buzzer-generating sound alarm pattern, DC motor-controlling motor speed using PWM, LED- controlling LED brightness using PWM, Servomotor- moving the motor to a certain angle.

UNIT-V (Networking and cloud)
Arduino and computer networking, networking fundamentals, Obtaining the IP address, Networking extensions for Arduino with libraries and class, architecture of IoT web applications, IoT cloud platforms, develop cloud-based IoT applications.

Textbooks:
1. Python programming for Arduino by Pratik desai, Packt Publishing.
2. Internet of Things with Arduino Cookbook by Marco Schwartz.
3. Introduction to Arduino by Alan G. Smith.

References
1. Beginning Arduino by Michael McRoberts, 2e.
2. Getting Started with Arduino Massimo Banzi Second Edition.

OPEN ELECTIVE	L	T	P	C
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19CSXO02 - FOUNDATION TO DATA ANALYTICS				

COURSE OUTCOMES:

1. To understand the basics of Excel as business analytics.
2. To use of basic functions and statistical functions in Excel
3. To obtain knowledge about using of pivot tables and charts
4. To understand the advanced business analytics related charts
5. To know about statistical concepts for data analysis and basics of Power BI.

UNIT – I

Introduction to spreadsheets: reading data, manipulating data. Basic spreadsheet operations and functions.

Introduction to Business analytics: Introduction, Types of Analytics, Area of Analytics.

UNIT – II

Spreadsheet Functions to Organize Data: Conditional formatting, Logical functions: Lookup and reference functions, IF, Nested IF, VLOOKUP, HLOOKUP, MATCH, INDEX and OFFSET functions in Excel.

Statistical functions: Introduction, SUMIFS, COUNTIF, PERCENTILE, QUARTILE, STDEV, MEDIAN and RANK Function

UNIT – III

Introduction to Filtering, Pivot Tables, and Charts: Introduction to the data filtering capabilities of Excel, the construction of Pivot Tables to organize data and introduction to charts in Excel.

Pivot Table Introduction: Creating a Pivot Table, Grouping in Pivot Table, Custom Calculated Field and Calculated Item, Slicer Introduction, Creating a Slicer

UNIT – IV:

Advanced Graphing and Charting: Constructing various Line, Bar and Pie charts. Using the Pivot chart features of Excel. Understanding and constructing Histograms and Scatterplots.

Business analytics with Excel: Introduction, Histogram, Data Table, Descriptive Statistics.

UNIT – V:

Data Analysis Using Statistics: Introduction, Moving Average, Hypothesis Testing, ANOVA, Covariance, Correlation, Regression, Normal Distribution.

Power BI: Introduction, Power Pivot, Power View, Power Query, Power Map.

Reference Books:

1. Advanced Analytics with Excel 2019: Perform Data Analysis using Excel's Most Popular Features (English Editions), 2020

2. Beginning Excel What-If Data Analysis Tools: Getting Started with Goal Seek, Data Tables, Scenarios, and Solver – Illustrated, Paul Cornell, 2005.

Website Link for Reference:

1. https://www.excel-easy.com/data-analysis.html

OPEN ELECTIVE	L	T	P	C
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19CSXO03 - DATA ENGINEERING				

COURSE OUTCOMES:

1. At the end of the course Students will be able to:
2. Apply the skills of data inspecting and cleansing.
3. Determine the relationship between data dependencies using statistics
4. Can handle data using primary tools used for data science in Python
5. Represent the useful information using mathematical skills
6. Can apply the knowledge for data describing and visualization using tools.

UNIT I INTRODUCTION

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications

UNIT II DESCRIBING DATA I

Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graphs – averages – mode – median – mean – averages for qualitative and ranked data – describing variability – range – variance – standard deviation – degrees of freedom – interquartile range – variability for qualitative and ranked data

UNIT III PYTHON FOR DATA HANDLING

Basics of Numpy arrays – aggregations – computations on arrays – comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

UNIT IV DESCRIBING DATA II

Normal distributions – z scores – normal curve problems – finding proportions – finding scores – more about z scores – correlation – scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r2 – multiple regression equations – regression toward the mean

UNIT V PYTHON FOR DATA VISUALIZATION

Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – three dimensional plotting – geographic data – data analysis using statmodels and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (first two chapters for Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Chapters 1–7 for Units II and III)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Parts of chapters 2–4 for Units IV and V)

REFERENCES:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

OPEN ELECTIVE	L	T	P	C
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19CSXO04 - MACHINE LEARNING				

Course outcomes:

At the end of the course students are able to

1. Define basic concepts of machine learning.
2. Evaluate and compare the performance or, other qualities of regression and logistic regression.
3. Describe concepts of artificial intelligence.
4. Design a supervised or unsupervised learning system.
5. Define the knowledge about SVM.
6. Demonstrate Instance based learning algorithms.

UNIT I: Introduction

Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning. Concept learning and the general to specific ordering – Introduction, a concept learning task, Concept learning as search, Find- S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.

UNIT II: Linear Regression & Logistic Regression

Predicting numeric values: regression – Finding the best fit lines with linear regression, locally weighted linear regression, Shrinking Coefficients, The bias / Variance tradeoff. Logistic Regression: Classification with logistic regression and the sigmoid function, using optimization to find the best regression coefficients.

UNIT III: Artificial Neural Networks

Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition, Advanced topics in artificial neural networks.

UNIT IV: Evaluation Hypotheses

Motivation, Estimation hypothesis accuracy, Basics of sampling theory, a general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms.

UNIT V: Support vector machines & Dimensionality Reduction techniques

Separating data with the maximum margin, finding the maximum margin, efficient optimization with SMO algorithm, speeding up optimization with full platt SMO, Using Kernels for more Complex data. Dimensionality Reduction techniques: Principal Component analysis, Example.

Instance-Based Learning

Introduction, k -Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

TEXT BOOKS

3. Machine Learning, Tom M. Mitchell, MGH
4. Machine Learning in Action, Peter Harington, 2012, Cengage.`

REFERENCE BOOKS

1. Introduction to Machine Learning, Ethem Alpaydin, PHI, 2004

OPEN ELECTIVE	L	T	P	C
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19ECXO01: NANO TECHNOLOGY AND APPLICATIONS				

COURSE OUTCOMES:

Students are able to

CO1. Define Nano materials and Nano Technology with properties
CO2. Explain Synthesis as Fabrication methods of Nano Technology
CO3. Demonstrate Characterization techniques of Nano Materials
CO4. Analyze carbon Nano technology and application of Nano technology.

UNIT-I
INTRODUCTION: History of nano science, definition of nano meter, nano materials, nano technology, Classification of nano materials, Applications in material science, biology and medicine, surface science, energy and environment, Crystal symmetries, crystal directions, crystal planes, Band structure,

UNIT-II
PROPERTIES OF MATERIALS: Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

UNIT-III
SYNTHESIS & FABRICATIONMETHODS: Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography.

UNIT-IV
CHARECTERIZATION TECHNIQUES: X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy.

UNIT-V
CARBON NANO TECHNOLOGY: Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nanocrystalling diamond films, grapheme, applications of carbon nanotubes, carbon nanotubes for nanoelectronics devices.

TEXT BOOKS:

1. Nano science and nano technology by M.S RamachandraRao, Shubra Singh, Wiley publishers. **(UNITS-I,II&III)**
2. Fundamentals of nano electronics by George W Hanson Pearson publications, India 2008 **(Unit- I, IV&V)**

REFERENCE BOOKS:

1. Introduction to Nano Technology by Charles P. Poole, Jr., Frank J.Owens, Wiley publishers.
2. Principles of Nanotechnology by Phani Kumar, Scitech.

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19ECXO02 - GLOBAL POSITIONING AND NAVIGATION SATELLITE SYSTEMS				

COURSE OUTCOMES:
Upon completion of this course, the student would be able to

CO1: Describe the concepts of GNSS based positioning methods, the core components of a satellite navigation system and their purposes**.**
CO2: Estimate and represent the GPS coordinate frames and GPS orbits.
CO3: Analyze the impact of various error sources on the precision of positioning.
CO4: Dramatize the examples of their role of goods and services based on the GSP in sustainable development.

UNIT - I
Overview of GPS: Basic concept, system architecture, space segment, user segment, services of GPS, applications of GPS.

UNIT - II
GPS Signals: Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

UNIT - III
GPS coordinate frames, Time references: Geodetic and Geo centric coordinate systems, ECEF coordinate world geodetic 1984 (WGS 84), GPS time.

UNIT - IV
GPS orbits and satellite position determination: GPS orbital parameters, description of receiver independent exchange format (RINEX)–Observation data and navigation message data parameters, GPS position determination.

UNIT - V
GPS Errors: GPS error sources – clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver.

TEXT BOOKS:

2. G. S. RAO, Global Navigation Satellite Systems, 2nd Edition, McGraw-Hill publications, New Delhi, 2010. **(UNIT-I-V)**

REFERENCE BOOKS:

5. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, 'GPS – Theory and Practice', 4th Edition, Springer – Wien, New York , 2001. (UNIT-I-III)
6. Sateesh Gopi, "Global Positioning System: Principles and Applications", 3rd Edition, TMH, 2005. (UNIT-I-II)
7. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software Approach', 3rd Edition, John Wiley & Sons, 2001. (UNIT-IV-V)
8. Elliot D. Kaplan, "Understanding GPS Principles and Applications", 2nd edition, Artech House, 2005. (UNIT-I-III)

E-REFERENCES:

1. http://www.unoosa.org/oosa/sk/ourwork/psa/gnss/gnss.html
   https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/gps/howitworks/
2. https://www.princeton.edu/~alaink/Orf467F07/GNSS.pdf
3. https://www.euspa.europa.eu/european-space/eu-space-programme/what-gnss

   https://www.gps.gov/systems/gnss/

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19ECXO03 - REMOTE SENSING				

COURSE OUTCOMES:

After Completion of this course, students are able to

CO1: Understand the subject of satellite communication and remote sensing with the core knowledge of space and satellite, communication and the international space laws.
CO2: Comprehend different remote sensing signaling techniques, capable of interpreting signature of satellite communication from bodies like soil, vegetation and ocean.
CO3: Analyze various components used in satellite communication and remote sensing applications.
CO4: Acquire and keep abreast of designing satellite remote sensing system and also analyze the sensor data for drawing inference and conclusions.

UNIT I
Introduction: Historical background, International space laws, Advantages of space based observations, Global coverage, Multiscale observation, repeat observation immediate transmission and digital format, Source of information on remote sensing region.

UNIT II
Principles of remote sensing: Fundamentals of remote sensing signals, Theelectromagnetic spectrum, Terms and units of measurements, EM radiation laws,Spectral signature in the solar spectrum, vegetation reflectance, soil reflectance,water in the solar spectrum, The thermal infrared domain, characteristics of EM radiation in thermal infrared, Thermal properties of vegetation, Soils thermal domain, thermal signature of water and snow, The microwave region, Atmospheric interaction.

UNIT III
Sensors and remote sensing satellite: Type of sensors, Resolution of sensor systems, spatial, spectral, radiometric, temporal, angular - resolution, passive sensors, photographic cameras, cross and along track - scanners, active sensors, Radar and Lidar, satellite remote missions, Satellite orbits, Landsat programs, SPOT satellites, IRS program, High resolution commercial satellites, Polar orbiting meteorological satellites, Terra Aqua, Geostationary meteorological satellites.

UNIT IV
Basis for interpretations of remote sensing images: Constraints in using remote sensing data, types of interpretation, Costs of data acquisitions, end-user requirements, Thematic classification, Generation of biophysical variables, Change detection, spatial patterns, organization of remote sensing project, interpretation phase, presentation of study cases.

UNIT V
Characteristic of photographic images, Feature identification, criteria for visual interpretation, Brightness, color, texture, spatial contexts, shadows, spatial patterns, shape and size, stereoscopic view, period of acquisition, elements of visual analysis, Geometric characteristics of satellite image, Color composites, Multitemporal approaches.

TEXTBOOKS:
1. Emilio Chuvieco, “Fundamentals of Satellite Remote Sensing”, CRC press, Edition,2009.

REFERENCES:
1.C. H. Chen, “Signal Processing for Remote Sensing‖, CRC press, Edition-2007.
2. R. N Mutagi, “Satellite Communication Principles and Applications”, Oxford University press, 2016.
3. Enrico Del Re, and Marina Ruggieri, “Satellite communications and navigation systems”, Springer.

OPEN ELECTIVE	L	T	P	C
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19ECXO04 - MOBILE COMMUNICATION AND APPLICATIONS				

COURSE OUTCOMES:

Students are able to

CO1. Design Hexagonal shaped cells and how these are implemented in real world.

CO2. Explain different types of antenna systems in mobile communication.

CO3. Analyze Handoffs and different types of handoffs and Dropped call rates and their evaluation.

CO4. Describe the Parameters of Mobile multipath channels, Types of small scale fading.

UNIT-I

INTRODUCTION :

Evolution of Mobile Communications, Mobile Radio Systems around the world, First, Second, Third Generation Wireless Networks, Wireless Local Loop(WLL), Wireless LANs, Bluetooth, Personal Area Networks(PANs), A Simplified Reference Model, Applications.

UNIT-II

ELEMENTS OF MOBILE COMMUNICATIONS:

General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, consideration of the components of Cellular system.

UNIT-III

THE MOBILE CONCEPT :

Introduction, Frequency reuse, Handoff strategies, Interference and System Capacity: Co- Channel Interference, Channel Planning, Adjacent Channel Interference, Power control for reducing interference, Trunking and Grade of Service, Cell Splitting, Sectoring.

UNIT-IV

MOBILE RADIO PROPAGATION :

Introduction, Free space propagation model, The three basic propagation models-Reflection, Diffraction and Scattering, Two-ray model, Outdoor propagation models, Indoor propagation models, Signal Penetration into building, Small scale multipath Propagation, Parameters of Mobile multipath channels, Types of small scale fading.

UNIT-V

FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT:

Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment.

TEXTBOOKS:

1. Wireless Communications by Theodore S. Rappaport, principles and practice,2nd Editions. (**Unit-I, III, IV & V)**

2. Mobile Cellular Communication by Gottapu Sasibhushana Rao, Pearson International, 2012.

(UNIT - I, II, III &IV)

3. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edn., 2006. **(UNIT - V & VI)**

REFERENCES:

1. Wireless and Mobile Communications-Lee, McGraw Hill, 3rd Edition, 2006.

2. Wireless Communications and Networks-William Stallings, Pearson Education, 2004.

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19ITXO01 : SOFTWARE ENGINEERING PRINCIPLES				

COURSE OUTCOMES

After the completion of the course the students are able to

1. Identify, formulate, and solve software engineering problems.
2. Elicit, analyze and specify software requirements with various stakeholders of a software development project.
3. Implement the techniques for project planning and estimation.
4. Participate in design, development, deployment and maintenance of a medium scale software development project.
5. Evaluate the impact of potential solutions to software engineering problems in a global society, using the knowledge of models, tools, and techniques.

UNIT-I

Introduction to Software Engineering: The evolving role of software, Software Characteristics, Changing Nature of Software, Software myths.

A Generic view of Process: Software engineering- A layered technology, a Process framework, The Capability Maturity Model Integration (CMMI), Process assessment, Product and Process.

UNIT-II

Process models: The waterfall model, Incremental process models, Evolutionary process models, The Unified process.

Software Requirements: User requirements, System requirements, Functional and non-functional requirements, the Software Requirements Document (SRS).

UNIT-III

Requirements Engineering Process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

Project planning and estimation: Project Planning Activities, Software Metrics and Measurements, Project Size Estimation, Effort Estimation Techniques: COCOMO, PERT/CPM method.

UNIT-IV

Design Engineering: Design process and Design quality, Design concepts, Software Architecture, Architectural Styles and Patterns.

Object-Oriented Design: Objects and object classes, An Object-Oriented design process, Design evolution

UNIT-V

Performing User Interface Design: Golden Rules, User interface analysis and design, interface design steps, Design evaluation.

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Validation testing, System testing , the art of Debugging, Black-Box and White-Box testing.

Text Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, McGrawHill International Edition.
2. Software Engineering- Sommerville , 9th edition, Pearson education.

References Books:

1. Software Engineering- K.K. Agarwal & Yogesh Singh, New Age International Publishers
2. Software Engineering, an Engineering approach- James F. Peters, WitoldPedrycz, John Wiely.
3. Systems Analysis and Design- ShelyCashman Rosenblatt, Thomson Publications.
4. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.

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19ITXO02 : CLOUD COMPUTING PRINCIPLES				

COURSE OUTCOMES

After the completion of the course the students are able to

1. Explain basics of cloud computing technology.
2. Demonstrate the concept of virtualization and the development of Cloud Computing.
3. Analyze various cloud services and service providers.
4. Explain and Uses cloud scalability, security and disaster management.
5. Understand the different cloud platforms and its application.

UNIT-I

Introduction to Cloud: Cloud Computing at a Glance, the Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model. Characteristics and Benefits, Challenges Ahead, Historical Developments.

UNIT-II

Virtualization: Introduction, Characteristics of Virtualized Environment, Classification of Virtualization Techniques, Virtualization and Cloud computing, Pros and Cons of Virtualization, Technology Examples-VMware and Microsoft Hyper-V.

Before the Move into the Cloud: Know Your Software Licenses, The Shift to a Cloud Cost Model, Service Levels for Cloud Applications.

UNIT-III

Cloud Computing Architecture : Introduction, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance.

UNIT-IV

Defining the Clouds for Enterprise: Storage as a service, Database as a service, Process as a service, Information as a service, and Integration as a service and Testing as a service. Scaling cloud infrastructure - Capacity Planning, Cloud Scale. Disaster Recovery: Disaster Recovery Planning, Disasters in the Cloud, Disaster Management.

UNIT-V

Cloud Applications: Scientific Applications – Health care, Geo science and Biology. Business and Consumer Applications- CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming.

Cloud Platforms in Industry: Amazon Web Services- Compute Services, Storage Services, Communication Services and Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life-Cycle, cost model. Microsoft Azure- Azure Core Concepts, SQL Azure.

Text Books:

1. "Mastering Cloud Computing" by Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi from TMH 2013.
2. George Reese "Cloud Application Architectures", First Edition, O'Reilly Media 2009.

Reference Books:

1. Cloud Computing and SOA Convergence in Your Enterprise, *A Step-by-Step Guide* by David S. Linthicum from Pearson 2010.
2. Cloud Computing, 2nd Edition by Dr. Kumar Saurabh from Wiley India 2012.
3. Cloud Computing, – web based Applications that change the way you work and collaborate Online – Micheal Miller.Pearson Education.

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19ITXO03 : E-COMMERCE				

COURSE OUTCOMES

After the completion of the course the students are able to

1. Define the fundamentals E-commerce framework.
2. Explain the basics of Consumer Oriented Electronic models.
3. Distinguish different electronic payment systems and their issues.
4. Demonstrate Inter-organizational and intra-organizational electronic commerce.
5. Explain advertising and marketing on the Internet, consumer search and resource discovery and key multimedia concepts.

UNIT-I

Electronic Commerce-Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

UNIT-II

Consumer Oriented Electronic commerce - Mercantile Process models, Electronic payment systems - Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

UNIT-III

Inter Organizational Commerce - EDI, EDI Implementation, Value added networks. Intra Organizational Commerce - work Flow, Automation Customization and internal Commerce, Supply chain Management.

UNIT-IV

Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses. Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research.

UNIT-V

Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering.

Multimedia - key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing, Desktop video conferencing.

Text Books:

1. Frontiers of electronic commerce – Kalakata, Whinston, Pearson.

References Books:

1. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, TharamDillon,Ellizabeth Chang, John Wiley.
2. E-Commerce, S.Jaiswal – Galgotia.E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
3. Electronic Commerce – Gary P.Schneider – Thomson.
4. E-Commerce – Business, Technology, Society, Kenneth C.Taudon, Carol GuyericoTraver.

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19ITXO04 : WEB TECHNOLOGY PRINCIPLES				

COURSE OUTCOMES

After the completion of the course the students are able to

1. Basic Knowledge about World Wide Web.
2. Develop Simple HTML Web Pages
3. Create Style Sheets for HTML Pages.
4. Acquire Knowledge about Client – side validation through Java Script.
5. Basic Knowledge about XML Documents.

UNIT-I

Introduction to WWW: Protocols and programs, secure connections, application and development tools, the web browser, What is server, choices, setting up UNIX and Linux web servers, Logging users, dynamic IP.

Web Design: Web site design principles, planning the site and navigation.

UNIT- II

HTML5: Introduction, Basic Formatting Tags, Block and inline elements, Lists, Image, Hyperlink, Table, Iframe, Form Elements, Layout Elements and Miscellaneous.

UNIT-III

CSS3: Introduction, CSS Syntax, Selectors, Add CSS to HTML : External, Internal and Inline, CSS Styling : Backgrounds, Text, Fonts, Links, Lists, Tables, CSS Box Model.

UNIT-IV

Javascript : Client side scripting, What is Javascript, How to develop Javascript, simple Javascript, variables, functions, conditions, loops and repetition, Javascript own objects, the DOM and web browser environments, forms and validations.

UNIT-V

XML EXTENSIBLEMARKUP LANGUAGE: XML- Document type Definition, XML schemas, Document object model.

TEXT BOOKS:

1. Internet and World Wide Web – How to program by Dietel and Nieto PHI/Pearson Education Asia.
2. Web Technologies – Black Book, Kogent Learning solutions Inc sol. Dreamtech press.

REFERENCE BOOKS:

- W3Schools Online Web Tutorials (https://www.w3schools.com/)

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19BMXO01 : INNOVATIONS AND ENTREPRENEURSHIP				

UNIT-I INNOVATION MANAGEMENT: Concept–Objectives-types of Innovation-process of Innovation- sources of Innovation-Levels of Innovation -barriers of Innovation-–Open and Closed Innovation-challenges faced while managing innovation.

UNIT-IICREATIVEINTELLIGENCE: Concept of Creativity-Importance-Characteristics-Types of Creativity-Traits Congenial to Creativity-Triarchic theory of Intelligence – Creative thinking –Types-process of creative thinking-Sources and techniques for generating ideas.

UNIT-III ENTREPRENEURSHIP: Concept- characteristics-Importance-classification-Theories of Entrepreneurship-entrepreneurship development-entrepreneurial process- challenges-Women Entrepreneurs.

UNIT-IVPROJECT FORMULATION AND APPRAISAL: Concept -Need-Significance-steps - Economic Analysis; Financial analysis; Market analysis; Technical feasibility-project Appraisal-techniques of project appraisal.

UNIT-V INSTITUTIONS PROMOTING SMALL BUSINESS ENTERPRISES: Central level Institutions; SIDBI, NSIC, KVIC,SSIDC - State level Institutions- DICs – SFC- SSIDC- other financial assistance, Government policy and taxation benefits- government policy for SSIs

TEXT BOOKS:

1. Vasanth Desai, ―Entrepreneurship, Himalaya Publishing House, New Delhi, 2012
2. Arya Kumar: ―Entrepreneurship, Pearson, Publishing House, New Delhi, 2012.
3. Keith Goffin and Rick Mitchell-Innovation Management,Springer,2016

REFERENCES BOOKS:

1. Pradip N Khandwalla, Lifelong Creativity, An Unending Quest, Tata McGraw Hill, 2004.
2. Vinnie Jauhari, Sudanshu Bhushan, Innovation Management, Oxford Higher Education, 2014

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19BMXO02 : INDUSTRIAL SOCIOLOGY AND PSYCHOLOGY				

UNIT I: Industrial Sociology: Nature and Scope of Industrial Sociology-Development of Industrial Sociology, Factors of social change – the technological factors, the cultural factors, effects of technology on major social institutions, social relations in industry.

UNIT II: Group Dynamics: Concept- factors influencing individual behaviour- Work Teams & Groups, Group Behavior, Group formation & development, Decision Making by Individuals, Groups Decision making process-techniques.

UNIT III Industrial Psychology: Nature and Meaning of Industrial Psychology, Role of Industrial Psychology, Organizational Attitude, Motivation at work-Theories of Motivation (Theory X and Y, McClelland's Theory, Maslow's Need Theory, Herzberg's Two Factor Theory), Cultural Differences in Motivation.

UNIT IV: Organizational Design and Leadership: Organizational Design & Structure- organizational design- process, Structural differentiations, factors influencing design of organizations, Leadership-concept, types, Leadership vs. Management, Leadership Theories, Emerging issues in Leadership.

UNIT V Organizational Conflictsand Change management: Concept - Causes and Consequences of Conflict-Conflict handling techniques, Managing Change, Forces for change in Organization, Resistance to change.

TEXT BOOKS:

1. Nelson, Quick and Khandelwal, ORGB : An innovative approach to learning and teaching Organizational Behaviour. A South Asian Perspective, Cengage Learning, 2012

2. Luthans, Fred, Organizational Behavior, McGraw Hill, 2008.

3.Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.

REFERENCES BOOKS:

1. Gisbert Pascal, Fundamentals of Industrial sociology, Tata McGraw Hill Publishing Co., New Delhi, 1972.

2. Schneider Engno V., Industrial Sociology 2nd Edition, McGraw Hill Publishing Co., New Delhi,2011.

3.Ivancevich, Konopaske &Maheson, OrganisationalBehaviour& Management, 7th edition, Tata McGraw Hill, 2008.

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19BMXO03 : DIGITAL MARKETING				

UNIT I- Introduction to Digital Marketing: Concept – scope- importance of digital marketing - Traditional marketing versus digital marketing – Types of digital marketing-marketing mix and its implications for digital marketing--Challenges and opportunities for digital marketing

UNIT II- Content Marketing: Understanding Content Marketing, Content Creation Framework, Content marketing strategy and planning- Types of content marketing -Measuring and Analysing Your Content-Viral Marketing-Blog Marketing.

Unit III- Search Engine Optimization (SEO): What is SEO? SEO Importance and Its Growth in recent years, Ecosystem of a search Engine , kinds of traffic, Keyword Research & Analysis (Free and Paid tool & Extension), Recent Google Updates

UNIT IV-Email and Mobile Marketing: Introduction, process, design, content,email marketing metrics. Mobile Marketing: Concept, Process-tools-opportunities and challenges.

UNIT V-Social Media Marketing: Concepts- Process - Tools- Google and the Search Engine, Facebook, Twitter, YouTube and LinkedIn- Issues: Credibility, Fake News, Paid Influencers; social media and Hate/ Phobic campaigns.

TEXT BOOKS:

1. Puneet Singh Bhatia, "Fundamentals of Digital Marketing", Pearson Education Publications, 2nd edition 2019
2. Seema Gupta, "Digital Marketing", McGraw Hill Publications", 2nd edition 2020
3. Ryan Deiss, Russ Henneberry, "Digital Marketing For Dummies", Wiley Publications, 2020

REFERENCES BOOKS:

1. Joe Pulizzi, "Epic Content Marketing", McGraw Hill Education, 2019
2. Puneet Singh Bhatia , "Social Media & Mobile Marketing", Wiley Publications, 2019

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19BMXO04 : BUSINESS ENVIRONMENT				

Unit-I Business Environment: Components and Significance – Economic Scope – Factors Influencing Business Environment – Dimensions of International Business Environment – Challenges.

Unit-II: Structure of Indian Economy: Economic systems- Economic planning with special reference to last three plans, public, private joint and cooperative sectors - Industrial Policy - Policy Resolutions of 1991- Economic Reforms-PPP

Unit-III Indian Business Environment: Competitiveness, Changes and Challenges, Sustainable Development, Social Responsibilities, Ethics in Business- Competition Act 2002 - Emerging Trend in Indian Business Environment

Unit-IV: International Trade: Balance of Payments – Concepts, Disequilibrium in BOP: Methods of Correction - Trade Barriers and Trade Strategy - Free Trade vs. Protection -World Financial Environment: Foreign Exchange Market Mechanism, Exchange Rate Determination, and Euro Currency.

Unit-V: Globalisation: International Economic Integration, Country Evaluation and Selection, Foreign Market Entry Methods, International Trading Blocks – WTO Origin, Objectives, Organisation, Structure and Functioning – WTO and India.

TEXT BOOKS:

1. Chidambaram, Indian Business Environment, Vikas, New Delhi
2. Suresh Bedi: Business Environment, Excel, New Delhi.
3. K.V.Sivayya and VBM Das: Indian Industrial Economy, Sultan Chand Publishers, Delhi.

REFERENCES BOOKS:

1. Pandey G.N., Environmental Management, Vikas Publishing House.
2. Sundaram & Black, International Business Environment – The Text and Cases, Prentice Hall of India.
3. Ghosh PK., Business Environment,Sultan Chand & Sons, New Delhi
4. Daniel John D and Redebough, Lee. H., International Business, Addision Wesley India
5. Saleem, Business Environment, Pearson, New Delhi.
6. Bhalla, V.K., & S. Sivaramu, International Business Environment and Business, Annual Publications

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19MAXO01 : OPERATIONS RESEARCH				

COURSE OBJECTIVES:

1.Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, machines etc) more effectively.

2.Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry

UNIT—I

LINEAR PROGRAMMING:

Introduction-General formulation LPP- Formulation of LP problems - Graphical solution –Slack and Surplus and Artificial variables-simplex method (simple problems) - artificial variable techniques – twophase method, Big-M-method(simple problems) –Concept of Duality-general rules for converting any primal into its dual.

UNIT – II

TRANSPORTATION PROBLEM:

Introduction-mathematical formulation-Feasible, Basic Feasible and Optimum solution -Methods for initial basic feasible solution to transportation problem-optimal Test by u, v method(MODI)-Degeneracy in Transportation problems –.Unbalanced Transportation problems

UNIT – III

SEQUENCING PROBLEM:

Introduction –Johnson's Algorithm for n jobs 2 machines- Optimal Solution for processing n jobs through two machines- processing n jobs through three machines - processing n jobs through m machines - processing two jobsthrough m machines

UNIT – IV

REPLACEMENT PROBLEMS:

Introduction – replacement policy for items whose maintenance cost increases with time, and money value is constant – Money value, present worth Factor and Discount Rate- replacement policy when maintenance cost increases with time and money valuechanges with constant rate – Individual Replacement Policy-group replacement of items that fail completely.

UNIT – V

WAITING LINES:

Introduction- transient and steady states-Probability Distributions in Queening systems-Kendall's notation for Representing Queening models- Single channel-Poisson arrivalsExponential service times-with infinitepopulation model (M/M/1: FIFO/∞/∞)

INVENTORY:

Introduction – types of inventory models – Costs involved in Inventory problems-Variables in inventory problem-Classification of Inventory Models-Concept of EOQ-The EOQ model without shortage – Quantity Discounts-purchase inventory models with one price break - purchase inventory models with two price breaks- purchase inventory models with any number of price breaks-shortages are not allowed

COURSE OUTCOMES: Students can able to

CO1: Formulate the resourcemanagement problem andidentify appropriate methods to solve them. [K3]

CO2: Applytransportation model to optimize the industrial resources. [K3]

CO3: Solve sequencing problems using operation research techniques. [K3]

CO4: Apply thereplacement model to increase the efficiency of the system. [K3]

CO5: Apply theinventory and queuingmodel to increase the efficiency of the system. [K4]

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TEXT BOOKS:

1. Operations Research / S.D.Sharma, Ramnath co,Meerut
2. Operations Research, P.K.Gupta, D.S.Hira,S.Chand

REFERENCE BOOKS:

1. Operations Research /A.M.Natarajan,P.Balasubramani, A.Tamilarasi/PearsonEducation.
2. Operations Research / R. Pannerselvam, PHI Publications.

OPEN ELECTIVE	L	T	P	C
	3	-	-	3
19MAXO02 : OPTIMIZATION MODELS				

COURSE OBJECTIVES:

1.Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals,materials,machines etc.,) more effectively.

2.Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry

UNIT—I

INTRODUCTION TO LINEAR PROGRAMMING:

Introduction-Linear programming problem formulation – General formulation of Linear programming problem- formulation of LP problems - Graphical solution – simplex method (simple problems) - artificial variable techniques – twophase method, Big-M-method – general rules for converting any primal into its dual.

UNIT – II

ASSIGNMENT MODELS::

Formulation –mathematical formulation of assignment problem – Hungarian method for assignment problem- Unbalanced assignment Problems-variations in the assignment problem-Travelling Salesman problem.

UNIT – III

THEORY OF GAMES:

Introduction – minimax (maxmin) criterion and optimal strategy –solution of games with saddle points – rectangular games without saddle points –reduce game by dominance –-graphicmethod for m x 2 & 2 x n games-arithmetic method for finding optimum strategies and game value.

UNIT – IV

DECISION THEORY:

Introduction –decision making environments - decision making under conditions of certainty- decision making under conditions of uncertainty-Maximax criterion-maximin criterion-minimax regret criterion-Hurwitz criterion-Laplace criterion-decision making under conditions of risk-expected value criterion-expected opportunity loss criterion-expected value of perfect information.

UNIT-V

PROJECT MANAGEMENT:

Phases of project management-network logic-numbering the events(Fulkerson's rule)- – identifying critical path – probability of completing the project within given time- Project Evaluation and Review Technique.

COURSE OUTCOMES: Students are able to

CO1: Apply linear programming techniques to solve industrial optimization problems. [K3]
CO2: Solve assignment problems using operation research techniques. [K3]
CO3: Analyze game theory and apply them for optimization. [K4]
CO4: Solvethe decision theory problem through the applications of game theory. [K4]
CO5: Scheduling the production and manage the project [K4]

TEXT BOOKS:

1. Operations Research / S.D.Sharma, Ramnath co,Meerut
2. Operations Research / R.Pannerselvam,PHIPublications

REFERENCE BOOKS:

1. Operations Research /A.M.Natarajan,P.Balasubramani, A.Tamilarasi/PearsonEducation.
2. Operations Research, P.K.Gupta, D.S.Hira,S.Chand

OPEN ELECTIVE	L	T	P	C
	3	-	-	3
19BSXO01 : QUANTUM COMPUTING				

Pre-requisite: Basics of Quantum Mechanics and Computer Science

Objective of the course: The objective of this course is to provide the students an introduction to quantum computation. Much of the background material related to the algebra of complex vector spaces and quantum mechanics is covered within the course.

Unit – I

Background Mathematics, Physics and Introduction to Quantum Computation: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis, Quantum bits, Bloch sphere representation of a qubit, multiple qubits. **(8 Hours)**

Unit – II

Quantum Circuits: Single Qubit gates, multiple qubit gates, design of quantum circuits. **(8Hours)**

Unit – III

Quantum Information and Cryptography: Comparison between classical and quantum information theory. Bell states. Quantum teleportation.QuantumCryptography, no cloning theorem. **(8 Hours)**

Unit – IV

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Data base Search, FFT and prime factorization, Deutsch's Algorithm. **(8 Hours)**

Unit – V

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation, Physical implementation of quantum computers. **(8 Hours)**

Text Books:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press (2002).
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computationand Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific (2004).
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms (2000).

OPEN ELECTIVE	L	T	P	C
	3	-	-	3
19BSXO02 : OPTOELECTRONICS				

COURSE OBJECTIVES:

A deep understanding of the fundamentals of optoelectronics including Optical emission from semiconductors ,quantum efficiency, heterojunction, quantum well, Optoelectronic modulators. Be familiar with recent trends in optoelectronics.

COURSE OUTCOME:

Students who successfully complete this course will have an

- ability to understand the fundamental concepts of Optoelectronics;
- ability to understand the concept of optoelectronic modulators
- ability to design single-mode junction lasers at different wavelengths to meets specs;
- ability to incorporate heterostructures and quantum wells to improve device performance;
- ability to design junction & avalanche photodiodes to meet specs

UNIT – I

Electronic properties of Semiconductors:

Effect of temperature on band gap, density of carriers in intrinsic and extrinsic semiconductors, conduction processes in semiconductors, electron-hole pair formation and recombination, PN junction, carrier recombination and diffusion, Injection efficiency, heterojunction, internal quantum efficiency, double heterojunction, quantum well and super lattices.

UNIT – II

Opto Electronic Modulators: Basic principles, Polarization, birefringence. Electro-optic Modulators-electro optic effect, integrated optical modulator, EO materials. Kerr modulators, scanning and switching.

Magneto Optic Modulators: Faraday effect, Accusto-optic Modulators, Magneto-optic modulators.

UNIT – III

Opto-electronic devices: Injection luminescence and LED, LED structures, LED-Materials, Power and efficiency, hetereostructure LED. Laser: Basic concepts, Optical emission from semiconductors- Hetero junction lasers. Semiconductor Injection Lasers, Injection laser structures- gain guided lasers, index guided lasers, Distributed Feedback Lasers.

UNIT – IV

Opto-electronic Display devices: Photo luminescence, cathode luminescence, Electro luminescence, CRT, Plasma panel display, LCD and LED displays- liquid crystals, properties, Numeric displays

UNIT – V

Optoelectronic detectors: Thermal detectors, Photon devices- Photo emissive detectors, Photo conductive detectors, Photomultipliers (PMT), Image intensifiers, Photo diodes- PIN & APD, photo transistors.

Design of detector arrays: CCD, Solar cells.

Text Books:

1. Opto electronics - An introduction - J Wilson and J F B Hawkes. (PHI)
2. Optical fiber communication - J M Senior (Pearson, 2nd Ed)
3. Fiber Optics and Optoelectronics – R P Khare, (Oxford University Press, 4th Ed)

References:

1. Solid State Electronic Devices - Ben G Streetman, Sanjaykumar Banerjee, PHI, 6th Ed, 2006)
2. Fundamentals of Photonics- B E A Saleh and M C Teich, (John Wiley, 2007)