Academic Regulations

Program structure & Detailed Syllabus

2017

For

Under Graduate Programme (B.Tech)

Electronics and Communication Engineering

(Applicable For Batches Admitted From 2017 – 2018)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY
(AUTONOMOUS)

DUVVADA - VISAKHAPATNAM – 530 049

(An Autonomous Institute, Accredited by NAAC, Affiliated to JNTUK, Kakinada, AP)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY

(AUTONOMOUS)

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ACADEMIC REGULATIONS

(VR 17)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY (AUTONOMOUS)
VISAKHAPATNAM

ACADEMIC REGULATIONS for B. Tech. (Regular)
(Applicable for the batches admitted 2017-18 onwards)

The Admission of students into B. Tech. course shall be as per the Govt. of Andhra Pradesh rules.

1. Award of B. Tech. Degree

A student will be declared eligible for the award of the B. Tech. degree if he/she fulfils the following academic regulations.

a. Pursue a program of study for not less than four academic years and not more than eight academic years.
b. For lateral entry scheme admission: Pursue a program of study for not less than three academic years and not more than six academic years.
c. For the award of a degree, regular candidate has to register for 189 credits and shall secure 189 credits.
d. Lateral entry candidate has to register for all the courses from second year onwards and secure all the credits registered for.

2. Courses of Study

The following courses of study are offered at present for specialization in the B. Tech. Course.

S. No.	Course Code	Programme & Abbreviation
01	01	Civil Engineering (CE)
02	02	Electrical and Electronics Engineering (EEE)
03	03	Mechanical Engineering (ME)
04	04	Electronics and Communication Engineering (ECE)
05	05	Computer Science and Engineering (CSE)
06	12	Information Technology (IT)
07	19	Electronics and Computer Engineering (E.Com E)

And any other Course as approved by the authorities of the Institute from time to time.

3. Registration: A student shall register for courses in each semester as per the courses offered by the concerned department.

4. Curricular Program

The Curriculum of the four-year B. Tech Course has been designed to achieve a healthy balance between theory & lab hours, industry experience and to develop technical skills required for a career in the industry or a career in research.

5. Distribution and Weightage of Marks

i. The performance of a student in each semester shall be evaluated Subject-wise with a maximum of 100 marks for theory courses and 100 marks for practical course. The project work shall be evaluated for 200 marks.

ii. For theory course the distribution shall be 40 marks for Internal Evaluation and 60 marks for the End Semester Examinations.

Distribution of marks for theory course, practical course and Design/Drawing is detailed below:

5.1. Internal 40 marks for theory course shall be awarded as follows:

i) 25 marks for MID exams
ii) 10 marks for continuous assessment
iii) 5 marks for Attendance

MID marks shall be calculated with 80% weightage for best of the two MIDs and 20% weightage for other MID exam.

5.2. For practical courses (Laboratory): There shall be continuous evaluation during the semester. Each Lab exam is evaluated for 100 marks. 50 marks shall be awarded for internal examination and 50 marks shall be awarded for external examinations.

5.2.1. Internal marks shall be awarded as follows

i) Day to day assessment– 20 Marks
ii) Record – 10 Marks
iii) Internal laboratory exam– 20 Marks

5.2.2.The semester end examinations shall be conducted by the teacher concerned and external examiner

5.3. For the courses having design and/or drawing, (Such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 40 marks for internal evaluation.

5.3.1. Internal marks shall be awarded as follows:

i) 20 marks for Day-to-day assessment
ii) 15 marks for internal exam
iii) 5 marks for Attendance

There shall be two internal examinations in a semester and the internal marks shall be calculated with 80% weightage for best of the two internals and 20% weightage for other internal exam.
5.3.2. External examination shall be conducted for 60 marks.

5.4. Industrial Visit: The industrial visit shall be carried out in their domain during the summer vacation after the second year second semester. A student has to submit a report which will be evaluated for 100 marks and will be submitted to an internal evaluation committee comprising Head of the Department or his / her nominee and two senior faculty of the department including the industrial visits coordinator/ supervisor.

5.5. Industry- Oriented Mini Project: The Industry oriented mini project is carried out during the third year second semester vacation. The students have an option to choose their own area of

interest which may be related to the course work. Mini project report is evaluated for 100 marks in fourth year first semester before the first mid-term exam. Assessment is done by the supervisor /guide for 40 marks based on the work and mini project report. The remaining 60 marks are allocated for presentation by the student to a committee comprising of the project supervisor and senior faculties members nominated by Head of the Department.

5.6. MOOCs: It is an online course (Minimum of 12 weeks) to promote advanced knowledge suitable for placement and research.

To award credits, the student should get certificate after they have registered for written exam and successfully passed

(Or)

College will conduct the written examination/Viva-voce and award the credits and grades.

In case a student fails in any online course, he/she may be permitted to register for the same course or an alternate course decided by the department committee. The internal marks secured earlier will be nullified if the course is changed. The assessment procedure of MOOCs course remains same as general theory course.

Note: The registered course must not be same as any of the courses listed in the program structure of their regulation till final year including electives.

5.7. Technical Seminar: For Technical seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his/her understanding over the topic, and submit to the department, which shall be evaluated by the Departmental Committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

5.8. Comprehensive Viva: The Comprehensive Viva aims to assess the students' understanding in various subjects he / she studied during the B.Tech course of study. Comprehensive Viva is conducted for a total of 50 marks. It shall be conducted in IV Year II Semester. The Comprehensive Viva–Voce will be conducted by a Committee consisting of Head of the Department, & senior faculty members of the Department.

5.9. Internship: Internships help students to acquire in depth knowledge about a particular topic related to the program of study. Such extensive work is expected to create a platform for a job or further research in the chosen area. Interested students may opt for a full semester Internship during the fourth year second semester. Such students shall be exempted for equivalent theory course credits during that semester and the corresponding credits are awarded through the Internship. A self-study report, duly authorized by the industry supervisor / guide, shall be submitted at the end of the fourth year second semester. Internship report is evaluated for 400 marks in total. Internal assessment is done by the academic supervisor/guide for 100 marks based on the work and presentation of the internship report. The assessment for 300 marks is evaluated and awarded by a panel of members consisting of Head of the Department, Senior Faculty and Industry Expert.

5.10. Main Project: Out of total 200 marks for the project work, 80 marks shall be for Internal Evaluation and 120 marks for the external assessment. The Internal Evaluation shall be on the basis of two mid-term project reviews conducted during the progress of the project. The End Semester Examination (Viva-Voce) shall be conducted by the committee consists of an External Examiner, Head of the Department (internal examiner) and a senior faculty of the Department. The evaluation of project work shall be conducted at the end of the IV year.

5.11. Audit courses: All audit courses will be "Pass/Fail" type with no credit points allotted. The result of the student in the audit course will be notified in the marks memo. A student must pass all the audit courses registered to be eligible for the award of B. Tech. degree.

List of audit courses will be notified from time to time. An indicative list of courses is as shown below.

a) Professional Ethics & Human Values b) Any Foreign Language c) Journalism d) Finance e) Legal Sciences f) Social Sciences g) English for Special Purposes h) Fine Arts i) Clinical Psychology j) Intellectual Property Rights & Patents etc.

6. Attendance Requirements:

6.1. It is desirable for a candidate to have 100% attendance in the class in all the courses. However, a candidate shall be permitted to appear for the end semester examination if he/she has a minimum of 75% aggregate attendance in the semester. Student will not be permitted to write Mid examination if the attendance percentage is less than 75 % during the stipulated instruction duration. However, Academic Monitoring Committee shall review the situation and take appropriate decision.
Note: Special cases for students having extraordinary performance at National and International level will be considered by the Academic monitoring committee.

6.2. Condonation of shortage of attendance may be considered on Medical grounds maximum up to 10%, if the student provides the medical certificate to the HOD immediately after he / she recovers from the illness. Medical Certificate submitted afterwards shall not be permitted. Shortage of attendance equal to or above 65% and below 75%will be condoned on payment of fee as fixed by the competent authority and the student concerned will be permitted to take the end semester examination. ***This privilege is given only three times for regular student and only two times for lateral entry student during the entire program of study***.

6.3. Shortage of attendance may be considered for the students who participate in prestigious sports, co and extra-curricular activities if their attendance is in the minimum prescribed limit.

6.4. A student will be promoted to the next semester if satisfies attendance and credits requirement.

7. Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements.

For any course, student is considered to be passed upon securing minimum 35% marks in the external examination alone and minimum 50% marks from both internal and external examination put together

8. Promotion Policy:

To promote to III year, a student has to secure minimum 50% of total credits from I & II-year courses
To promote to IV year, a student has to secure minimum 50% of total credits from I, II & III-year courses
In case of Lateral entry students, to promote to IV year, a student has to secure minimum 50% of total credits from II & III-year courses

9. Supplementary examinations: Supplementary examinations for the odd Semester shall be conducted with the regular examinations of even semester and vice versa. In case a student fails in online courses/ industrial lecture(s), he/she may be permitted to register for another course/lecture(s).

10. Examinations and Evaluation

10.1. General guidelines

i. All the semester end examinations are conducted for duration of three hours
ii. External examination shall be conducted for 60 marks consist of five questions of internal choice carrying 12 marks each.
iii. For laboratory examinations, the evaluation is done by internal examiner and one external examiner.

10.2. Revaluation

There is a provision for revaluation of theory courses if student fulfils the following norms.

The request for revaluation must be made in the prescribed format duly recommended by the Chief Superintendent of Examinations through Additional Controller along with the prescribed revaluation fee.

11. Grading System:

CGPA

Marks Range (in %)	Letter Grade	Level	Grade Point
≥ 90	O	Outstanding	10
≥80 to <90	A	Excellent	9
≥70 to <80	B	Very Good	8
≥60 to <70	C	Good	7
≥50 to <60	D	Satisfactory	6
<50	F	Fail	0
		Absent	-1
		Withheld	-2
		Malpractice	-3

Computation of SGPA

The following procedure is to be adopted to compute the Semester Grade Point Average. (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

SGPA (Si) = Σ(Ci x Gi) / ΣCi

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th}course.

Computation of CGPA

- The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \Sigma(Ci \times Si) / \Sigma Ci$$

Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

- Equivalent Percentage = (CGPA – 0.75) X 10

12. Award of Class

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following three classes:

Class Awarded	CGPA to be secured	
First Class with Distinction	≥ 7.75 without course failures during entire duration of study	**CGPA secured from 189 Credits.**
First Class	≥ 6.75 to <7.75	
Second Class	≥ 5.75 to < 6.75	

13. General Instructions

i. Where the words 'he', 'him', 'his', occur, they imply 'she', 'her', 'hers', also.

ii. The academic regulations should be read as a whole for the purpose of any interpretation.

iii. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman, Academic Council is final.

iv. The college may change or amend the academic regulations or syllabi from time to time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institution.

14. Transitory Regulations

i. The student has to continue the course work along with the regular students of the respective semester in which the student gets re-admission.

ii. The student has to register for Substitute / Compulsory courses offered in place of courses studied earlier.

iii. The mode of internal evaluation and end-semester examinations shall be on par with the regular students, i.e., the student has to follow the mode of internal evaluation and the then question paper model for the end-semester examinations along with the regular students of the respective semester in which the student gets re-admission. The marks secured in the internal and end-semester examinations will be pro-rated in accordance with the regulations under which the student was first admitted.

iv. For the courses studied under earlier regulations but failed, the student has to appear, pass and acquire credits from the supplementary examinations as and when conducted. The question paper model shall remain same as the one in which the student took examination during previous regulations.

v. The promotion criteria based on attendance as well as credits shall be in accordance with the regulations under which the student was first admitted.

vi. All other academic requirements shall be in accordance with the regulations under which the student was first admitted.

vii. The decision of the Principal is final on any other clarification in this regard.

viii. Transcripts: After successful completion of the entire program of study, a transcript containing performance of all academic years will be issued as a final record. Partial transcript will also be issued up to any point of study to a student on request, after payment of requisite fee.

15. Minimum Instruction Days

The minimum instruction days for each semester shall be 16 weeks

There shall be no branch transfers after the completion of the admission process.

16. Withholding of Results

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

Note: All other regulations including attendance requirements related to four year B. Tech Regular program will be applicable for B.Tech. Lateral Entry Scheme.

17. Malpractices Rules

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/ Improper conduct	Punishment
1 (a)	If the candidate possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	If the candidate gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	If the candidate has copied in the examination hall from any paper, book, programmable calculators, palm computers	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has

	or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3	If the candidate impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	If the candidate smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	If the candidate uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	If the candidate refuses to obey the orders of the Chief Superintendent/Assistant - Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be

	hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	permitted to appear for the remaining examinations of the courses of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	If the candidate leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	If the candidate possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college, expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred

		and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and. a police case will be registered against them.
10	If the candidate comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Academic committee of the Institute for further action to award suitable punishment.	

18. UGC RECOMMENDED PUNISHMENT FOR RAGGING

i. Suspension from attending classes and academic privileges
ii. Withholding/withdrawing scholarships/fellowship and other benefits.
iii. Debarring from appearing in any test/examination or other evaluation process
iv. Withholding results
v. Debarring from representing the institution in any regional, national or international meet, tournament, youth festival etc.
vi. Suspension/expulsion from the hostel
vii. Cancellation of admission
viii. Rustication from the institution for period ranging from 1 to 4 semesters.
ix. Expulsion from the institution and consequent debarring from admission to any other institution for a specified period.
x. Fine may extend up to Rs. 2.5 lakh.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
PROGRAM STRUCTURE

I Year- I Semester

S. No	Course Code	Course Title	L	T	P	Credits
1	1000171101	English- I	3	1	0	3
2	1000171102	Engineering Mathematics-I	3	1	0	3
3	1000171103	Engineering Mathematics-II	3	1	0	3
4	1000171105	Computer Programming using C	3	1	0	3
5	1000171106	Engineering Drawing	3	1	0	3
6	1000171111	Applied Chemistry	3	1	0	3
7	1000171121	English- Communication Skills Laboratory-I	0	0	3	2
8	1000171124	IT Workshop	0	0	3	2
9	1000171128	Computer Programming Lab	0	0	3	2
Total Credits						**24**

I Year – II Semester

S. No	Course Code	Course Title	L	T	P	Credits
1	1000171201	English- II	3	1	0	3
2	1000171203	Engineering Mathematics-III	3	1	0	3
3	1000171207	Applied Physics	3	1	0	3
4	1000171209	Network Analysis	3	1	0	3
5	1000171212	Environmental Studies	3	1	0	3
6	1000171213	Data Structures	3	1	0	3
7	1000171221	English Communication Skills Lab-2	0	0	3	2
8	1000171222	Engineering Physics Laboratory	0	0	3	2
9	1000171228	Data Structures Programming Lab	0	0	3	2
Total Credits						**24**

II Year- I Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1	1004172101	Electronic Devices and Circuits	3	1*	0	3
2	1004172102	Switching Theory and Logic Design	3	1*	0	3
3	1004172103	Signals and Systems	3	1*	0	3
4	1004172104	Electrical Technology	3	1*	0	3
5	1004172105	Random Variables and Stochastic Process	3	1*	0	3
6	1004172106	Mathematics-IV	3	1*	0	3
7	1004172121	Electronic Devices and Circuits Lab	0	0	3	2
8	1004172122	Networks & Electrical Technology Lab	0	0	3	2
		Total Credits:				22

II Year- II Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1	1004172201	Electronic Circuit Analysis	3	1*	0	3
2	1004172202	Control Systems	3	1*	0	3
3	1004172203	Electromagnetic Waves and Transmission Lines	3	1*	0	3
4	1004172204	Analog Communications	3	1*	0	3
5	1004172205	Pulse and Digital Circuits	3	1*	0	3
6	1099172207	Engineering Economics and Management Science	3	1*	0	3
7	1004172221	Electronic Circuit Analysis Lab	0	0	3	2
8	1004172222	Analog Communications Lab	0	0	3	2
9	1004172231	Industrial visit	0	0	0	2
Total Credits:						24

III Year- I Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1	1004173101	Linear IC Applications	3	1*	0	3
2	1004173102	Digital Communications	3	1*	0	3
3	1004173103	Computer Architecture and Organization	3	1*	0	3
4	1004173104	Digital IC Applications	3	1*	0	3
5	1004173105	Antennas and Wave Propagation	3	1*	0	3
6	1004173121	Integrated Circuits/Pulse and digital circuits Lab	0	0	3	2
7	1004173122	Digital Communications Lab	0	0	3	2
8	1004173123	Digital IC Applications Lab	0	0	3	2
9	1099172103	Professional Ethics & Human Values	3*	0	0	0
Total Credits						**21**

III Year- II Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1	1004173201	Microprocessors and Microcontrollers	3	1*	0	3
2	1004173202	Communication Networks	3	1*	0	3
3	1004173203	VLSI design	3	1*	0	3
4	1004173204	Digital Signal Processing	3	1*	0	3
5	**Open Elective-I**					
	1005173206	a) Introduction to Data Base Management systems	3	1*	0	3
	1005173207	b) Introduction to Python Programming				
	1005173208	c) JAVA Programming				
	1004173205	d) Soft Computing Techniques				
	1004173206	e) Bio medical Instrumentation				
6	**Open Elective-II (CBCS)(MOOCs)**					
	1004173291	*Any available online course approved by department committee at the time of semester commencement	3	1*	0	3

7	1004173221	Microprocessors and Microcontrollers Lab	0	0	3	2
8	1004173222	VLSI Lab	0	0	3	2
9	1004173223	Digital Signal Processing Lab	0	0	3	2
Total Credits						**24**

S.No.	Course Code	Course Title	L	T	P	Credits
10	1004173241	Industry Oriented Mini Project	0		0	2

IV B.Tech - I Semester

S.No	Course Code	Course Title	L	T	P	Credits
1	1004174101	Cellular and Mobile Communications	3	1*	0	3
2	1004174102	Digital Image Processing	3	1*	0	3
3	1004174103	Microwave Engineering	3	1*	0	3
4	1004174104	Optical Communications	3	1*	0	3
5	**Elective – I**		3	1*	0	3
	1004174105	a) IoT & its Applications				
	1004174106	b) System Design through Verilog				
	1004174107	c) Embedded Systems Design				
	1004174108	d) Global Positioning System(GPS)				
6	**Elective – II**		3	1*	0	3
	1004174109	a) Artificial Intelligence				
	1004174110	b) Speech Processing				
	1004174111	c) Micro Electromechanical Systems (MEMS)				
	1005172206	d) Operating Systems				
7	1004174121	Microwave engineering & Optical Communications Lab	0	0	3	2
8	1004174122	Digital Image Processing Lab	0	0	3	2
9	1099173101	IPR & patents	2	0	0	0
Total Credits						22

IV B.Tech II Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1	1004174201	Satellite Communications	3	1*	0	3
2	1004174202	Electronic Measurements and Instrumentation	3	1*	0	3
3	1004174203	Radar Systems	3	1*	0	3
4	**Elective – III**		3	1*	0	3
	1004174204	a) Data Science				
	1004174205	b) Low Power VLSI Design				
	1004174206	c) Wireless Communication and Networking				
	1004174207	d) Pattern Recognition				
(OR)						
	1004174281	Internship	0	0	0	12
5	1004174251	Technical Seminar	0	3	0	2
6	1004174261	Comprehensive Viva	0	0	0	2
7	1004174231	Main Project	0	0	0	10
					Total Credits	26

PROGRAM STRUCTURE

FOR

I-B.Tech

I & II SEMESTERS

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
PROGRAM STRUCTURE

I Year- I Semester

S. No	Course Code	Course Title	L	T	P	Credits
1	1000171101	English- I	3	1	0	3
2	1000171102	Engineering Mathematics-I	3	1	0	3
3	1000171103	Engineering Mathematics-II	3	1	0	3
4	1000171105	Computer Programming using C	3	1	0	3
5	1000171106	Engineering Drawing	3	1	0	3
6	1000171111	Applied Chemistry	3	1	0	3
7	1000171121	English- Communication Skills Laboratory-I	0	0	3	2
8	1000171124	IT Workshop	0	0	3	2
9	1000171128	Computer Programming Lab	0	0	3	2
Total Credits						**24**

I Year – II Semester

S. No	Course Code	Course Title	L	T	P	Credits
1	1000171201	English- II	3	1	0	3
2	1000171203	Engineering Mathematics-III	3	1	0	3
3	1000171207	Applied Physics	3	1	0	3
4	1000171209	Network Analysis	3	1	0	3
5	1000171212	Environmental Studies	3	1	0	3
6	1000171213	Data Structures	3	1	0	3
7	1000171221	English Communication Skills Lab-2	0	0	3	2
8	1000171222	Engineering Physics Laboratory	0	0	3	2
9	1000171228	Data Structures Programming Lab	0	0	3	2
Total Credits						**24**

DETAILED SYLLABUS FOR

I-B.Tech

I-SEMESTER

Course Code		L	T	P	Credits
1000171101	**ENGLISH-I**	3	1	0	3

Course Objectives

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To enable the students to study and comprehend the prescribed lessons and subjects more effectively related to their theoretical and practical components.
- To develop the communication skills of the students in both formal and informal situations.
- Practice critical thinking to develop innovative and well-founded perspectives related to the students' emphases. Build and maintain healthy and effective relationships.
- To convey a credible message and create concise messages using a structured writing process.
- To develop effective interpersonal communication skills.

Course Outcomes

After completing this Course, the student should be able to:

- Use English language, both written and spoken, competently and correctly.
- Improve comprehension and fluency of speech.
- Gain confidence in using English in verbal situations.
- Display competence in oral, written, and visual communication.
- Communicate ethically.
- Demonstrate positive group communication exchanges.

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Enhance English Language by relating the ideas of eminent personalities.	Understanding	PO6,PO9, PO10, PO12
CO2	Articulate the technological advancements fluently.	Applying	PO10, PO12
CO3	Inculcate the art of thinking and writing clearly and logically.	Applying	PO10, PO12
CO4	Enact various themes through team work and learn the usage of vocabulary through humourous texts.	Analyzing	PO10, PO12

Detailed Text: English Essentials

1. **In London**-M. K.Gandhi
2. **The Knowledge Society**- A. P. J. AbdulKalam
3. **Principles of Good Writing -** L. A.Hill
4. **Man's Peril –** Bertrand Russell
5. **Luck -** MarkTwain

Non-Detailed Text: Panorama

1. **War** – Luigi Pirandello
2. **The Verger** – Somerset Maugham

PRESCRIBED TEXTBOOKS:

1. **English Essentials** by Ravindra Publishing House
2. **Panorama** by Oxford University Press

SUGGESTED TEXT BOOKS:

1. **You Can Win** by ShivKhera
2. **English for Engineers and Technologists** by Orient Black Swan
3. **Objective English** by R. S. Agarwal, S.Chand.co

REFERENCE BOOKS:

1. "Practical English Usage" by Michael Swan, 3rdEdition,OUP.
2. "Intermediate English Grammar" by Raymond Murphy,CUP.
3. "Study: Reading" by Eric H .Glendinning, 2ndEditionCUP.
4. "Business Correspondence and Report writing" by R.C Sharma, Tata McGrawhill

Course Code		L	T	P	Credits
1000171102	**ENGINEERING MATHEMATICS-I**	3	1	0	3

Course Overview:

This course deals with differential equations and its application with more focus on advanced Engineering Mathematics. This course helps the students to learn relevant mathematical tools which are required in the analysis of problems in engineering and scientific professions. Topics included in this course are differential equations of first order and their applications, higher order linear differential equations and their applications, functions of single variable and their applications and multiple integrals, Laplace transforms and their applications. The mathematical skills derived from this course form a necessary base for analytical and design concepts encountered in the program.

Course Objectives:

1. To explain mathematical modeling with the knowledge of differential equations.
2. To discuss higher order differential equations and its applications to solve engineering problems.
3. To evaluate maxima and minima of function of several variables.

Course Outcomes:

1. Solve basic engineering problems described by first order differential equations.
2. Determine solutions to higher order linear homogeneous and non homogeneous differential equations with constant coefficients.
3. Apply the techniques of multivariable differential calculus to determine extreme and series expansions etc. of functions of several variables.
4. Extend the concept of integration to two and three dimensions and support it through applications in engineering mechanics.
5. Appraise the Laplace transform technique and use it to solve various engineering problems.

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Solve linear differential equations of first and higher order.	Understanding	PO1,PO2, PO3, PO12
CO2	Determine extrema and series expansions of functions of several variables.	Applying	PO1, PO2,PO4, PO12
CO3	Determine double integral, triple integral to find area and volume..	Applying	PO1, PO2, PO3, PO12
CO4	Appraise Laplace transform to solve various engineering problems.	Analyzing	PO1, PO2, PO12

UNIT-I : MEAN VALUE THEOREMS:

Mean Value Theorems - Rolle's Theorem - Lagrange's mean value theorem – Cauchy's mean value theorem (without proofs)

ORDINARY DIFFERENTIAL EQUATIONS:

Exact equations and equations reducible to exact form- Linear equations- Bernoulli's equation.

Applications: Orthogonal trajectories ,Simple Electric Circuits

UNIT-II: LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER:

Linear differential equations of second and higher order with constant coefficients, Non-homogeneous term of the type $Q(x) = e^{ax}$, $\sin ax$, $\cos ax$, x^n, $e^{ax}V(x)$, $x^nV(x)$- Method of variation of parameters.

Applications: LCR Circuits

UNIT-III: FUNCTIONS OF SEVERAL VARIABLES:

Functions of several variables – Partial Differentiation –Euler's Theorem-Total Derivative – Change of variables - Jacobian -Functional dependence – Taylors theorem for functions of two variables.

Applications: Maxima and Minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT-IV: MULTIPLE INTEGRALS:

Introduction: Review of Coordinate Systems (Cartesian, Polar, Parametric, Spherical, Cylindrical) -multiple integrals - double and triple integrals – change of variables – Change of order of Integration.

Applications: Areas and Volumes of Simple curves (Cartesian)

UNIT-V: LAPLACE TRANSFORMS:

Introduction - Laplace transforms of standard functions – Shifting Theorems - Transforms of derivatives and integrals - multiplication by t^n- division by t – Unit step function –Dirac delta function. Laplace transform of Periodic functions. Introduction - Inverse Laplace transforms– Properties- Convolution theorem (without proof).

Applications: Solution of ordinary differential equation with constant coefficients (Initial Value Problems) using Laplacetrans forms.

TEXT BOOKS:

1. Higher Engineering Mathematics – 43rd Edition by Dr. B. S. Grewal, Khanna Publishers, New Delhi.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics, Erwin Kreszig, 8thEd, WileyStudent Edition.
2. Engineering Mathematics, Greenburg, 2nd Ed, Pearson education.
3. A Text book of Engineering Mathematics, N.P.Bali, Laxmi Publications(P) Ltd.
4. Advanced Engineering Mathematics, B. V. Ramana,TataMcGrawHill Publishing Co.Ltd.
5. Engineering Mathematics, P. Sivaramakrishna Das, C. Vijayakumari, 2017Pearson Education Services Pvt.Ltd

Course Code		L	T	P	Credits
1000171103	**ENGINEERING MATHEMATICS-II**	3	1	0	3

Course Overview:

The entire course material is divided into 5 modules covering duly recognized areas of theory and study. This course includes the topics of advanced Engineering Mathematics with more focus on the mathematical tools required to analyze the problems of Engineering & Scientific Professions. Some important topics of this course are Solutions of Algebraic and Transcendental Equations, Interpolation, Numerical integration and Numerical solution of ordinary differential equations, Fourier series and Fourier transforms. The main aim of this course is to provide a platform to the students to think, design, formulate and derive any problem encountered in real life situation.

Course Objective:

1. To formulate and apply numerical techniques for root finding, interpolation.
2. To estimate definite integrals using Newton-Cotes quadrature formula.
3. To compute numerical solution of ordinary differential equations.
4. To determine the Fourier coefficients of a given function.
5. To analyze the characteristics and properties of Fourier transforms.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Determine numerical solution of non Linear equation
2. Compute Interpolating polynomial for the given data
3. Explain Numerical Solution of ODE and Numerical Integration.
4. Construct Fourier series expansion of periodic functions
5. Determine Fourier transform, Fourier sine and cosine transform of function.

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Determine numerical solution of non Linear equation	Understanding	PO1,PO2, PO12
CO2	Compute Interpolating polynomial for the given data	Applying	PO1, PO2,PO12
CO3	Explain Numerical Solution of ODE and Numerical Integration.	Applying	PO1, PO2, PO4, PO12
CO4	Construct Fourier series and Fourier transforms for functions	Analyzing	PO1, PO2, PO3, PO5, PO6, PO12

UNIT-I: SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS & INTRODUCTION TO FINITE DIFFERENCES:

Bisection method - Regula-falsi method - Iteration method - Newton-Raphson method. Finite differences: Forward, Backward and Central differences - Other difference operators and relations between them - Differences of a polynomial – To find missing terms.

UNIT-II: INTERPOLATION

Newton's forward interpolation, Newton's backward interpolation, Gauss Forward and Backward interpolation, Interpolation with unequal intervals – Newton's divided difference - Lagrange's interpolation.

UNIT-III: **NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS AND NUMERICAL INTEGRATION**:

Single step methods: Taylor's series method –Picard's Method - Euler's and modified Euler's Methods - Fourth order Runge-Kutta method for solving first order equations. Numerical Integration: Trapezoidal Rule, Simpson's $1/3^{rd}$ Rule, Simpson's $3/8^{th}$ Rule

UNIT-IV: FOURIER SERIES:

Introduction- Determination of Fourier coefficients – Even and Odd functions – Change of interval– Half-range sine and cosine series-Practical Harmonic Analysis.

UNIT-V : FOURIER TRANSFORMS:

Fourier integral theorem (only statement) – Fourier sine and cosine integrals – Fourier transforms-Fourier Sine and Cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

TEXT BOOKS:

1. Higher Engineering Mathematics – 43^{rd} Edition by Dr. B. S. Grewal, Khanna Publishers, New Delhi

REFERENCE BOOKS:

1. Advanced Engineering Mathematics, Erwin Kreszig, 8^{th}Ed, Wiley Student Edition.
2. Engineering Mathematics, B.V.Ramana, Tata McGrawHill.
3. Mathematical Methods –Dr. Ravindranath & Dr. P. Vijaya Lakshmi,Himalaya
4. Engineering Mathematics, P.Sivaramakrishna Das, C.Vijayakumari ,2017Pearson Education Services Pvt.Ltd

Course Code	COMPUTER PROGRAMMING	L	T	P	Credits
1000171105	USING C	3	1	0	3

Course Objectives:

- Understanding the basics of the computers and background.
- Drawing flowcharts and Formulating algorithmic solutions to problems and implementing in C language.
- Understanding branching, iteration and data representation using arrays.
- Modular programming and recursive solution formulation.
  Understanding pointers and dynamic memory allocation.

Course Prerequisites:

Students should have knowledge of

- Basics of Computer Components.
- Distinction between software and hardware.

Course Outcomes:

Students will be able to:

- Understand the fundamentals of computers, solving the problems using flow charts, algorithms and pseudo code.
- Write, compile and execute simple programs in C language.
- Use different data types and operators in C language.
- Design programs involving decision structures, loops, functions and passing parameters to functions.
- Develop programs using arrays, structures and pointers.
- Understand the dynamic memory allocation functions using pointers.
- Understand the basics of file operations, reading, writing and updating the files.

	Course outcome	Skill	PO
CO1	Write compile and debug Programs in C language	Understand	PO1,PO2, PO3
CO2	Use operators, data types and write programs	Understand	PO1,PO2
CO3	Select the best loop construct for a given problem	Analyzing	PO3,PO5
CO4	Design and implement C programs	Analyzing	PO1,PO2 PO3,PO4, PO12

UNIT-I

Computer Basics – What is a computer, History of computers, Characteristics of computers, Classification of computers, Applications of computers, Components and functions of a Computer System: hardware and software concept, input/output devices, memory concept and secondary memories, Number System, Computer languages, Flow Charts, algorithms and pseudo code.

Introduction to C programming- Background and characteristics of C, Structure of a C Program, Input/Output Statements in C, writing C programs, compiling and executing C programs.

UNIT-II

Programming Style – Tokens of C, Keywords, Variables, Constants and rules to form variables and constants, Data Types, Declaration of Variables and initialization, Operators, Expression Types, Operator Precedence and Associativity. Implicit Type Conversions, Explicit Type Conversions (Casts), Assignment Variations, Mathematical Library Functions, Interactive Input, Formatted Output, Format Modifiers.

Flow of Control:
Selection: if and if-else Statements, if-else if statement and switch case, nested if, examples.

Repetition and Unconditional Control Statements: Pretest and Posttest Loops, Counter-Controlled and Condition-Controlled Loops, while Statement, do while statement, for Statement, Nested Loops. Break, continue and go to statements.

UNIT-III

Modular Programming:

Function and Parameter Declarations: Function definition, types of functions, declaration and definition of user defined functions, its prototypes and parameters, calling a function. Function stubs and Functions with and without Parameters. Variable Scope, Variable Storage Class, Local Variable Storage Classes, Global Variable Storage Classes.

Parameter passing Techniques: Pass by Value, recursive functions.

UNIT-IV
Arrays and Strings

Arrays: One-Dimensional Arrays, Declaration, Array Initialization, Input and Output of Array Values, Arrays as Function Arguments, Two-Dimensional Arrays, linear search, and bubble sort.
Strings: String Fundamentals, String Input and Output, String manipulation functions, String Processing, String manipulation operations without Library Functions.

UNIT-V

Pointers, Structures and Unions, Data Files

Pointers: Concept of a Pointer, Initialization of pointer variables, pointers as function arguments, Dangling memory, address arithmetic, character pointers and functions, pointers to pointers, Pointers and arrays, Pointers and strings, Array of Pointers, Dynamic memory management functions, parameter passing by address, command line arguments.

Structures and Unions: Derived types, Structures declaration, Initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit-fields.

Data Files: Declaring, Opening, and Closing File Streams, Reading from and Writing to Text Files, Random File Access.

Text Books:

- ANSI C Programming, Gary J. Bronson, Cengage Learning.
- Programming in C, Reema Thareja, and Oxford.
- Programming in C, Bl Juneja Anita Seth, Cengage Learning.

Reference Books:

- C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage. Pub.
- Programming with C, Bichkar, and Universities Press.
- The C Programming Language, Dennis Richie and Brian Kernighan, Pearson Education.
- C by Example, Noel Kalicharan, Cambridge

Course Code	ENGINEERING DRAWING	L	T	P	Credits
1000171106		3	1	0	3

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

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO number mapped
CO1	Understand the use of drawing instruments to construct the polygons and curves	Understanding	PO1,PO2,PO3
CO2	Learn the principle of orthographic projections. Draw Orthographic projections of points, lines.	Analyzing	PO1,PO2,PO3,PO12
CO3	Draw the various types of planes and solids its views in different Positions	Analyzing	PO1,PO2,PO3,PO12
CO4	Draw isometric views of simple objects	Analyzing	PO1,PO2,PO3,PO12

Unit I

Objective: To introduce the students to use drawing instruments and to draw polygons, Engg. Curves.

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

Curves: Parabola, Ellipse and Hyperbola by general methods, cycloids, involutes, tangents & normals for the curves.

Unit II

Objective: To introduce the students to use scales and orthographic projections, projections of points & simple lines.

Scales: Plain scales, diagonal scales and vernier scales

Orthographic Projections: Horizontal plane, vertical plane, profile plane, importance of reference lines, projections of points in various quadrants, projections of lines, lines parallel either to of the reference planes (HP,VP or PP)

Unit III

Objective: The objective is to make the students draw the projections of the lines inclined to both the planes.

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces- HT, VT

Unit IV

Objective: The objective is to make the students draw the projections of the plane inclined to both the planes.

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

Unit V

Objective: The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes.

Unit VI

Objective: The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa. Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGraw Hill Publishers
4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age.

Course Code	APPLIED CHEMISTRY	L	T	P	Credits
1000171111		3	1	0	3

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

Objectives:

- Plastics are nowadays used in household appliances; also they are used as composites (FRP) in aerospace and automotive industries.
- Fuels as a source of energy are a basic need of any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence they are introduced.
- The basics for the construction of galvanic cells as well as some of the sensors used in instruments are introduced. Also if corrosion is to be controlled, one has to understand the mechanism of corrosion which itself is explained by electro chemical theory.
- Understanding of crystal structures will help to understand the conductivity, semiconductors and superconductors. Magnetic properties are also studied.
- With the increase in demand, a wide variety of materials are coming up; some of them have excellent engineering properties and a few of these materials are introduced.

Outcomes: The student

- Gains basic knowledge of polymer materials and their engineering applications.
- Understands fuels which are used commonly and their advantages and limitations.
- Extends the principles involved in corrosion to predict and prevent the corrosion in real life system
- The advantages and limitations of semiconducting materials and their use in design would be understood.
- Recalls the principles, working and design of energy storage devises and Acquires knowledge of advanced materials and the applications.

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Identify various polymers like Polythene, PVC, Teflon, Bakelite and their Engineering applications.	Understanding	PO1,PO7, PO8
CO2	Desribe various renwable and non-renwable energy resources.	Applying	PO1, PO2, PO4, PO7, PO8

CO3	Aquire the knoweldge of principles and reaction mechanism Of corrosion.	Applying	PO1, PO7, PO8
CO4	Illustrate green Synthesis ,semiconductors , advanced materials and their applications in industry .	Analyzing	PO1, PO2, PO12

UNIT I: POLYMER TECHNOLOGY

Polymerization: Introduction - Types of polymerization (Addition, Condensation & Co-polymerization) – Physical and mechanical properties – advantages and limitations –

Plastics: Thermoplastics and Thermosetting plastics – Compounding, Moulding techniques (Compression, Injection &Blow moulding)

- Preparation, properties and applications of polyethene, PVC, Bakelite and Teflon.

Elastomers – Natural rubber- compounding and vulcanization – Synthetic rubbers - Buna S, Buna N and Thiokol – Applications. Composite materials & Fiber reinforced plastics (CFRP & GFRP) – Biodegradable polymers

– Conducting polymers.

UNIT II: FUEL TECHNOLOGY

Introduction – Classification – Calorific value - Bomb calorimeter – Numerical problems – Coal — Proximate and ultimate analysis and its Significance – Liquid fuels – Petroleum - Refining – Cracking – knocking - Octane and Cetane numbers

- Natural gas - LPG and CNG – Combustion – Flue gas analysis – Orsat apparatus – Numerical problems on combustion. Energy scenario in India – working of thermal power plant – Advantages and disadvantages – Non renewable energy – Solar energy – Harnessing of solar energy – solar heaters – photo voltaic cells – Bio energy – Biodiesel.

UNIT III: ELECTROCHEMICAL CELLS & CORROSION

Galvanic cells - Reversible and irreversible cells, Electrode potential – Standard electrodes (Hydrogen and Calomel electrodes) Electro chemical series and its applications,

Batteries-: Dry Cell, lead acid battery and Ni-Cd battery - H_2-O_2 fuel cell & H_3PO_4 fuel cells.

Corrosion: Introduction – Theories of Corrosion (dry and wet) – Types of corrosion – galvanic, pitting, stress, differential aeration and waterline corrosion

– Factors influencing corrosion – controlling methods – Design and material selection – Cathodic protection - inhibitors - Protective coatings – Metallic coatings (cathodic and anodic) - Methods of application on metals (Galvanizing, Tinning &Electroplating).

UNIT IV: SOLID STATE CHEMISTRY

Types of solids - close packing of atoms and ions - BCC , FCC, structures of rock salt - cesium chloride- spinel - normal and inverse spinels, Non-elemental ***semiconducting Materials****:* Stoichiometric, controlled valency &Chalcogenphoto/semiconductors, Preparation

of Semiconductors - Semiconductor Devices:- p-n junction diode as rectifier – junction transistor.

Insulators (electrical and thermal applications)

Magnetic materials: Ferro and ferri magnetism - Hall- Effect and its applications.

UNIT V: CHEMISTRY OF ADVANCED ENGINEERING MATERIALS

Nano materials: Introduction – Preparation, Properties and engineering applications of Carbon nano tubes and fullerenes.

Liquid crystals: Introduction – Types – Applications.

Superconductors: Type-I & Type-2, properties & applications.

Green Chemistry: Principles, any three methods of synthesis – engineering applications.

Sensors & Biosensors: Classification, working principle & applications.

Explosives & Propellants: Introduction, classification & applications.

Prescribed books:

1. Engineering Chemistry (16^{th}edn.) by Jain and Jain; Dhanpat Rai Publication Co.
2. A text book of Engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition

Reference Books:

1. Chemistry for Engineers by Teh Fu Yen, Imperial college press, London.
2. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others,2014 edition(second).
3. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.
4. Applied Chemistry by H.D. Gesser, Springer Publishers
5. Text book of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, University Press, IIM.

Course Code		L	T	P	Credits
1000171121	ENGLISH-COMMUNICATION SKILLS LABORATORY-I	0	0	3	2

Objectives: The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

- To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm.
- To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking.
- To improve the fluency in spoken English and neutralize mother tongue influence. To train students to use language appropriately to enhance Oratory Skills.

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Demonstrate the usage of phonemes while referring to the dictionary	Understanding	PO5,PO9, PO10, PO12
CO2	Articulate with others by using proper functions.	Applying	PO5,PO9, PO10, PO12
CO3	Enact the roles with proper body language.	Applying	PO5,PO9, PO10, PO12
CO4	Communicate fluently with proper pronunciation	Analyzing	PO5,PO9, PO10, PO12

Unit -1: Letters and Sounds

Unit-2: Interaction 1

Unit-3: The Sounds of English

Unit-4: Interaction 2

PRESCRIBED LAB MANUAL:

Speak Well - Orient Black Swan Publishers

SUGGESTED BOOKS/ MANUALS AND SOFTWARES:

1. Interact - Orient BlackSwan
2. Strengthen your Communication Skills by MaruthiPublishers
3. Personality Development and Soft Skills (Oxford University Press, New Delhi)
4. GRE-Barons-12thEdition
5. Objective English-R.S.Agarwal-S.ChandPublishers
6. The Rossettastone
7. English inMind

Course Code		L	T	P	Credits
1000171124	**IT WORKSHOP**	0	0	3	2

OBJECTIVES:

- Understand the basic components and peripherals of a computer.
- To become familiar in configuring a system.
- Learn the usage of productivity tools.
- Acquire knowledge about the netiquette and cyber hygiene.
- Get hands on experience in trouble shooting a system?

1. System Assembling, Disassembling and identification of Parts /Peripherals
2. **Operating System Installation**-Install Operating Systems like Windows, Linux along with necessary Device Drivers.
3. **MS-Office / Open Office**
   a. **Word** - Formatting, Page Borders, Reviewing, Equations, symbols.
   b. **Spread Sheet** - organize data, usage of formula, graphs, charts.
   c. **Power point** - features of power point, guidelines for preparing an effective presentation.
   d. **Access**- creation of database, validate data.
4. **Network Configuration & Software Installation**-Configuring TCP/IP, proxy and firewall settings. Installing application software, system software &tools.
5. **Internet and World Wide Web**-Search Engines, Types of search engines, netiquette, cyber hygiene.
6. Trouble Shooting-Hardware trouble shooting, Software troubleshooting.
7. **MATLAB-** basic commands, subroutines, graph plotting.
8. **LATEX-**basic formatting, handling equations and images.

TEXT BOOKS:

1. Computer Hardware, Installation, Interfacing, Troubleshooting and Maintenance, K.L. James, Eastern Economy Edition.
2. Microsoft Office 2007: Introductory Concepts and Techniques, Windows XP Edition ByGary B. Shelly, Misty E. Vermaat and Thomas J. Cashman (2007, Paperback).
3. LATEX- User's Guide and Reference manual, Leslie Lamport, Pearson, LPE, 2/e.

4. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers, Rudraprathap, Oxford University Press,2002.
5. Scott Mueller's Upgrading and Repairing PCs, 18/e, Scott. Mueller, QUE, Pearson,2008
6. The Complete Computer upgrade and repair book, 3/e, Cheryl A Schmidt, Dreamtech.
7. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech.

Course Code		L	T	P	Credits
1000171128	COMPUTER PROGRAMMING LAB	0	0	3	2

Learning Objectives:

- Understand the basic concept of C Programming, and its different modules that include conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures and File programming.
- Acquire knowledge about the basic concepts of writing a program in C 24language
- Demonstrate Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.
- Demonstrate Use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.
- Demonstrate Role of Functions involving the idea of modularity.

Outcomes:

- Apply and practice logical ability to solve the problems.
- Understand C programming development environment, compiling, debugging, and linking and executing a program using the development environment
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs
- Understand and apply the in-built functions and customized functions for solving the problems.
- Understand and apply the pointers, memory allocation techniques and use of files for dealing with variety of problems.

Exercise - 1 Basics

a) What is an OS Command, Familiarization of Editors - vi,Emacs.
b) Using commands like mkdir, ls, cp, mv, cat, pwd, andman.
c) C Program to Perform Adding, Subtraction, Multiplication and Division of two numbers From Command line.

Exercise - 2 Basic Math

a) Write a C Program to Simulate 3 Laws at Motion
b) Write a C Program to convert Celsius to Fahrenheit and viceversa

Exercise - 3 Control Flow - I

a) Write a C Program to Find Whether the Given Year is a Leap Year ornot.
b) Write a C Program to Add Digits & Multiplication of a number

Exercise – 4 Control Flow - II

a) Write a C Program to Find Whether the Given Numberis
   i) Prime Number
   ii) Armstrong Number
   b) Write a C program to print Floyd Triangle
   c) Write a C Program to print Pascal Triangle

Exercise – 5 Functions

a) Write a C Program demonstrating of parameter passing in Functions and returning values.
b) Write a C Program illustrating Fibonacci, Factorial with Recursion without Recursion

Exercise – 6 Control Flow - III

a) Write a C Program to make a simple Calculator to Add, Subtract, Multiply or Divide Using switch…case
b) Write a C Program to convert decimal to binary and hex (using switchcall function the function)

Exercise – 7 Functions - Continued

Write a C Program to compute the values of sin x and cos x and e^x values using Series expansion. (use factorial function)

Exercise – 8 Arrays Demonstration of arrays

a) Search-Linear.
b) Sorting-Bubble,Selection.
c) Operations onMatrix.

Exercises - 9 Structures

a) Write a C Program to Store Information of a Movie Using Structure
b) Write a C Program to Store Information Using Structures with Dynamically Memory Allocation c) Write a C Program to Add Two Complex Numbers by Passing Structure to a Function

Exercise - 10 Arrays and Pointers

a) Write a C Program to Access Elements of an Array Using Pointer
b) Write a C Program to find the sum of numbers with arrays and pointers.

Exercise – 11 Dynamic Memory Allocations

a) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc ()function.
b) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function. Understand the difference between the above two programs

Exercise – 12 Strings

a) Implementation of string manipulation operations **with** library function.
   i) copy
   ii) concatenate
   iii) length
   iv) compare
b) Implementation of string manipulation operations **without** library function.
   i) copy
   ii) concatenate
   iii) length
   iv) compare

Exercise -13 Files

a) Write a C programming code to open a file and to print it contents onscreen.
b) Write a C program to copy files

Exercise - 14 Files (Continued)

a) Write a C program merges two files and stores their contents in another file.
b) Write a C program to delete a file

DETAILED SYLLABUS FOR

I-B.Tech

II-SEMESTER

Course Code		L	T	P	Credits
1000171201	**ENGLISH-II**	3	1	0	3

Course Objectives

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To enable the students to study and comprehend the prescribed lessons and subjects more effectively related to their theoretical and practical components.
- To develop the communication skills of the students in both formal and informal situations.
- Practice critical thinking to develop innovative and well-founded perspectives related to the students' emphases. Build and maintain healthy and effective relationships.
- How to convey a credible message and create concise messages using a structured writing process.
- Develop effective interpersonal communication skills.

Course Outcomes

After completing this Course, the student should be able to:

- Use English language, both written and spoken, competently and correctly.
- Improve comprehension and fluency of speech.
- Gain confidence in using English in verbal situations.
- Display competence in oral, written, and visual communication.

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Enhance English Language skills through the concept of Technological advancements.	Understanding	PO6,PO9, PO10, PO12
CO2	Illustrate the life of eminent personalities for developing the skills of vocabulary and grammar	Applying	PO10, PO12
CO3	Emphasize the relevance of cultures and traditions for enhancing writing skills through literature	Applying	PO10, PO12
CO4	Correlate the importance of Environment and sustainability with an emphasis on language skills	Analyzing	PO10, PO12

Detailed Text: English Encounters

1. **A Dilemma**- A Layman looks at Science
2. **Culture Shock**
3. **Lottery**
4. **Health Threats of Climate Change**
5. **A Chief Architect of Microsoft**

Non-Detailed Text: Panorama

1. **A Scarecrow** - Satyajit Ray
2. **A Village Lost to the Nation** - Krishna Chandra Pujari

Prescribed Books:

1. **English Encounters** by MaruthiPublications
2. **Panorama** by Oxford UniversityPress

Course Code		L	T	P	Credits
1000171203	**ENGINEERING MATHEMATICS-III**	3	1	0	3

Course Overview:

This course focuses on basic theoretical concepts and advanced Engineering Mathematics. This course helps the students to understand mathematical tools required in the analysis of problems in Engineering and Scientific Professions. The topics included are Solution for linear systems, Eigen values & Eigen vectors, linear transformations, partial differential equations, Vector integral theorems(Green's, Stoke's and Gauss's divergence theorems). Thus mathematical skills derived from this course enable the students to design and solve the problems.

Course Objectives:

1. To explain the concepts of matrix algebra and methods of solving system of linear equations.
2. To compute Eigen values and Eigen vectors of real and complex matrices.
3. To apply properties of partial differential equations to obtain solution for science and engineering problems.
4. Classify and Solve partial differential equations
5. Generalize calculus to vector functions and to compute line, surface and volume integrals.

Course Outcomes:

Up on successful completion of this course, student will be able to:

1. Apply elementary transformations to reduce matrices to echelon form, normal form and hence find their rank.
2. Solve the system of linear equations and compute Eigen values and Eigen vectors of a square matrix.
3. Compute directional derivative and the gradient of functions of several variables.
4. Infer vector integral theorems to evaluate line, surface and volume integrals.

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Solve simultaneous linear equations numerically using rank of a matrix and compute Eigen values and Eigen vectors of a square matrix.	Understanding	PO1,PO2, PO3, PO12
CO2	Identify/classify and solve partial differential equations.	Applying	PO1, PO2, PO3, PO6, PO8

CO3	Calculate gradient of a scalar function, divergence and curl of a vector function.	Applying	PO1, PO2, PO3, PO12
CO4	Determine line, surface and volume integrals using appropriate integral theorems.	Analyzing	PO1, PO2, PO6, PO12

UNIT-I: LINEAR SYSTEMS OFEQUATIONS:

Introduction- Rank-Echelon form-Normal form-Solution of Linear systems - Gauss elimination- Gauss Seidel methods-Applications of matrix methods to finding current in the circuits.

UNIT-II: EIGEN VALUES-EIGEN VECTORS AND QUADRATIC FORMS

Introduction-Eigen values-Eigen vectors-Properties(without proofs)-Cayley Hamilton theorem (without proof) - Inverse and power of a matrix by using Cayley Hamilton theorem, Diagonalisation of matrix-Quadratic forms- Reduction of Quadratic form to Canonical form-Rank-Index-Signature-Nature- Applications of Eigen value and Eigen vectors to Free Vibrations of two mass system.

UNIT-III: PARTIAL DIFFERENTIALEQUATIONS:

Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions- Solutions of first order linear (Lagrange's) equation and nonlinear (standard type) equations- Equations reducible to standard forms.

UNIT-IV: VECTORDIFFERENTIATION:

Differentiation of vectors-Scalar and Vector point functions- Gradient of a scalar field and directional derivatives- Divergence and Curl of a vector field and its physical interpretation- Solenoidal and Irrotational of a vector- Vector identities.

UNIT-V: VECTORINTEGRATION:

Line integral- Circulation, Work done, Surface and Volume integrals-Vector integral theorems: Green's, Stoke's and Gauss's Divergence theorems (without proofs) and related problems.

TEXT BOOKS:

1. Higher Engineering Mathematics – 43rd Edition by Dr. B. S. Grewal, Khanna Publishers, New Delhi.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics, Erwin Kreszig, 8thEd, Wiley Student Ed
2. Advanced Engineering Mathematics, Greenburg, 2nd Ed, Pearson education.
3. Engineering Mathematics, N.P.Bali, Laxmi Publications (P)Ltd.
4. Engineering Mathematics, B. V. Ramana, TataMcGrawHill Publishing Co. Ltd.
5. Engineering Mathematics, P.Sivaramakrishna Das, C.Vijayakumari ,2017 Pearson India Education Services Pvt.Ltd
6. Advanced Engineering Mathematics, Cengage India, by Peter V O'Neil

Course Code	APPLIED PHYSICS	L	T	P	Credits
1000171207		3	1	0	3

Course Objective:

- To enhance the fundamental knowledge in Physics and its applications relevant to various Streams of Engineering and Technology.

Learning Objectives:

- Impart Knowledge of Physical Optics phenomena like Interference, Diffraction and Polarization involving required to design instruments with higher resolution.
- Teach Concepts of coherent sources, its realization and utility optical instrumentation.
- Study the concepts regarding the bulk response of materials to the EM fields and their analytically study in the back-drop of basic quantum mechanics.
- Understand the physics of Semiconductors and their working mechanism for their utility in sensors.

Outcome:
Construction and working details of instruments, ie., Interferometer, Diffractometer and Polarimeter are learnt. Study EM-fields and semiconductors under the concepts of Quantum mechanics paves way for their optimal utility.

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Describe the wave phenomena and working principle of optical instruments.	Understanding	PO1,PO2, PO3, PO9, PO12
CO2	Apply the knowledge of basic quantum mechanics, to set up one-dimensional Schrodinger's wave equation.	Applying	PO1, PO2, PO9, PO12
CO3	Identify the importance of classical and quantum mechanical treatment of materials.	Applying	PO1, PO2, PO9, PO12
CO4	Make use of the basic concepts of energy bands in crystalline solids to understand semiconductor physics.	Analyzing	PO1, PO2, PO9, PO12

UNIT-I

INTERFERENCE: Principle of Superposition – Coherent Sources – Interference in thin films (reflection geometry) – Newton's rings – construction and basic principle of Interferometers.

UNIT-II

DIFFRACTION: Fraunhofer diffraction at single slit cases - Circular Aperture (Qualitative treatment only) - Grating equation - Resolving power of a grating, Telescope and Microscopes.

POLARIZATION: Types of Polarization – Double refraction - Quarter wave plate and Half Wave plate – Working principle of Polarimeter (Sacharimeter).

UNIT-III

ELECTROMAGNETIC FIELDS: Scalar and Vector Fields – Electric potential- Gradient, Divergence of fields – Gauss and Stokes theorems – Maxwell's equations in differentialforms.

UNIT-IV

QUANTUM MECHANICS: Introduction – Matter waves – Schrodinger time independent and time dependent wave equations – Particle in abox.

FREE ELECTON THEORY: Defect of classical free electron theory – density of states – Quantum free electron theory – concept of Fermienergy.

UNIT-V

BAND THEORY OF SOLIDS: Kronig- Penney model – energy bands in crystalline solids – classification of crystalline solids- effective mass of electron and concept of hole.

SEMICONDUCTOR PHYSICS: Conduction – Density of carriers in Intrinsic and Extrinsic- Semiconductors – Fermi energy in intrinsic and extrinsic semiconductors- Drift & Diffusion –Einstein's equation- Hall effect in semiconductors.

Text Books:

1. A Text book of Engineering Physics – by Dr. M.N.Avadhanulu and Dr. P.G.Kshirasagar, S.Chand& Company Ltd.,(2014)
2. Physics by David Halliday and Robert Resnick – Part I and PartII

Reference Books:

1. Applied Physics by P.K.Palanisamy, Scitech publications(2014)
2. Lasers and Non-Linear optics by B.B.Laud, New Age International Pub. (2008).
3. Engineering Physics by M. Arumugam, Anuradha Publication(2014)
4. Modern Engineering Physics by A.S.Vasudeva
5. University Physics by Young andFreedman
6. Engineering Physics by D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)
7. Engineering Physics by R.K. Gaur and S.L.Gupta

Course Code	NETWORKANALYSIS	L	T	P	Credits
1000171209		3	1	0	3

COURSE OBJECTIVES:

- To understand the basic concepts on RLC circuits.
- To know the behavior of the steady states and transients states in RLC circuits.
- To know the basic Laplace transforms techniques in periods' waveforms.
- To understand the two port network parameters.
- To understand the properties of LC networks and filters.

COUSE OUTCOMES:

The student will be able to:

- Gain the knowledge on basic network elements.
- Will analyze the RLC circuit's behavior in detailed.
- Analyze the performance of periodic waveforms.
- Gain the knowledge in characteristics of two port network parameters (Z, Y, ABCD, h &g).
- Analyze the filter design concepts in real world applications.

UNIT-1

Introduction to Electrical Circuits: Network elements classification, Electric charge and current, Electric energy and potential, Active and passive elements and their series and parallel combination. Energy sources: Ideal, Non-ideal, Independent and dependent sources, Source transformation, Kirchoff's laws, Mesh analysis and Nodal analysis problem solving with resistances only including dependent sources also.

Fundamentals: Definitions of terms associated with periodic functions: Time period, Angular velocity and frequency, RMS value, Average value, Form factor and peak factor-problem solving, Phase angle, Phasor representation, Addition and subtraction of phasors, mathematical representation of sinusoidal quantities, explanation with relevant theory, problem solving. Principal of Duality with examples.

Network Topology: Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basic tie set schedule, basic cut set schedule.

UNIT – II

Steady State Analysis Response to sinusoidal excitation - pure resistance, pure inductance, pure capacitance, impedance concept, phase angle, series R-L, R-C, R-L-C circuits problem solving. Complex impedance and phase of notation for R-L,R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving.

Coupled Circuits: Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Natural current, Dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

UNIT – III

Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, Condition for maximum impedance, current in anti-resonance, Bandwidth of parallel resonance, general case- resistance present in both branches, anti-resonance at all frequencies.

Network Theorems: Thevinin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens- problem solving using dependent sources also.

UNIT – IV

Two-port networks: Relationship of two port networks, Z-parameters, Y- parameters, transmission line parameters, h-parameters, Inverse h- parameters, Inverse Transmission line parameters, Relationship between parameter sets, Parallel connection of two port networks, Cascading of two port networks, series connection of two port networks, problem solving including dependent sources also.

UNIT – V

Transients: First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non- homogenous, problem solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots. Solutions using Laplace transform method.

TEXT BOOKS:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, 3rd Edition,2000.
2. Network Analysis by K.Satya Prasad and S Sivanagaraju, Cengage Learning
3. Electric Circuit Analysis by Hayt and Kimmarle, TMH

REFERENCES:

1. Network lines and Fields by John. D. Ryder 2nd edition, Asia publishing house.
2. Basic Circuit Analysis by DR Cunninghan, Jaico Publishers.
   Network Analysis and Filter Design by Chadha, Umesh Publications

Course Code	ENVIRONMENTAL STUDIES	L	T	P	Credits
1000171212		3	1	0	3

Course Overview:

The course gives a broad view on the importance of environment and its conservation. It deals with distribution of biotic and abiotic components on the Earth, their over exploitation and its associated problems. It provides knowledge on different types of environmental pollutions and their control aspects. It develops practical orientation towards environmental concerns.

Course Objectives:

The objectives of the course are:

- Classify, describe and explains the concept of Ecosystems and Environmental Engineering.
- Overall understanding of different types of natural resources and its conservation.
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
- An understanding of the environmental impacts of developmental activities and the importance of Environmental Management.
- Awareness on the social issues, environmental legislations and global treaties.

Course Outcomes

- Give an outline of the natural resources and their importance for the sustenance of life and recognize the need to conserve the natural resources.
- Explain the concepts of the ecosystem and its function in the environment; explains the need for protecting the producers and consumers in various ecosystems and their role in the food web
- Elucidate the biodiversity of India and threats to biodiversity and conservation practices to protect the biodiversity
- Give a broad view on various attributes of pollution and their impacts and measures to reduce or control the pollution along with waste management practices.

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Elucidate the natural resource & their importance for the sustenance of life and recognises the need to conserve natural resource	Understanding	PO2,PO5, PO6, PO7, PO12
CO2	Gives the broad view on the various attributes of pollution & and their impact & measure to reduce he pollution along with waste management	Applying	PO2,PO3, PO5, PO6, PO7, PO12
CO3	Debates on social issues both rural and urban environment possible means to combat the challenges and trace the legislation of India towards sustainability	Applying	PO1, PO2,PO5, PO6, PO7, PO12
CO4	Educates about Environmental Impact Assessment, Environmental Impact Statement & Environmental Audit	Analyzing	PO1, PO2, PO4, PO5, PO6, PO7, PO12

UNIT - I

Multidisciplinary nature of Environmental Studies & Natural Resource

Definition, Scope and Importance of Environmental Engineering – Sustainability: Stockholm and Rio Summit–Global

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, conflict 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 - II

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.

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.

Solid Waste Management: Sources, classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products.

UNIT – III

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.

UNIT - IV

Ecosystems, Biodiversity & Conservation

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem.

- Producers, consumers and decomposers. -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.

Biodiversity and its conservation

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

UNIT - V

Environmental Management and Field Studies

Impact Assessment and its significance various stages of EIA, Preparation of EMP and EIS, Environmental audit. Eco-tourism, Environmental Economics & Study of a Ecotourism spot in a local area, Visit to some Polluted site. Environmental diary.

Text Books:

1. Environmental Studies by R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
2. A Textbook of Environmental Studies by Shaashi Chawla, TMH, NewDelhi
3. Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

References:

1. Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada
3. Environmental Studies by Benny Joseph, Tata McGraw Hill Co, NewDelhi
4. Environmental Studies by Piyush Malaviya, Pratibha Singh, Anoopsingh:Acme Learning, New Delhi

Course Code	DATA STRUCTURES	L	T	P	Credits
1000171213		3	1	0	3

Course Objectives:

1) To be familiar with basic techniques handling problems with Data structures.
2) Solve problems using data structures such as linear lists, stacks, queues, hash tables.

Course Prerequisites:

Students should have knowledge of

1) Basics of Computer Components
2) Distinction between software and hardware
3) Awareness regarding data availability and its usage

Course Outcome:

Students will be able to:

1) Apply advanced data structure strategies for exploring complex data structures.
2) Compare and contrast various data structures and design techniques in the area of performance
3) 3) Implement all data structures like stacks, queues, trees, lists and graphs and compare their Performance and tradeoffs

UNIT-I : ARRAYS

Abstract Data Type, The Array as an Abstract Data Type, The Polynomial Abstract Data type- Polynomial Representation- Polynomial Addition. Spares Matrices, Introduction- Sparse Matrix Representation- Transposing a Matrix, Representation of Arrays.

UNIT-II : STACKS AND QUEUES

The Stack Abstract Data Type, The Queue Abstract Data Type, Evaluation of Expressions, Expression-Postfix Notation- Infix to Postfix.

UNIT-III: LINKED LISTS

Single Linked List, Circular Lists, Available Space Lists, Linked Stacks and Queues, Polynomials, Polynomial Representation- Adding Polynomials- Circular List Representation of Polynomials, Sparse Matrices, Sparse Matrix Representation- Sparse Matrix Input- Deleting a Sparse Matrix, Doubly Linked Lists.

UNIT-IV: TREES

Representation of Trees, Binary Trees, The Abstract Data Type, Properties of Binary Tress, Binary Tree Representations, Binary Tree Traversal, Introduction, In-order Traversal Pre-order Traversal, Post-order Traversal, Binary Search Trees, Definition, Searching a Binary Search Tree

UNIT-V: SEARCHING, SORTING and GRAPHS

Searching: Linear and Binary search
Sorting: Bubble Sort, Insertion Sort, Quick Sort, Merge Sort
The Graph Abstract Data Type, Introduction, Definition, Graph Representation, Elementary Graph Operation, Depth First Search, Breadth First Search

Text Books:

Fundamentals of Data structures in C, Ellis Horowitz, S.Sahni, Andrews Freed, University Press (India). (Second Edition)

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

Reference Books:

Classic Data Structures, Debasis Samantha, PHI. (Second Edition)

Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI. Data Structures using C, Reema Thareja, Oxford Home Publications, Second Edition.

Course Code	ENGLISH COMMUNICATION SKILLS LAB-II	L	T	P	Credits
1000171221		0	0	3	2

Objectives:

- This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:
- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts. They would be required to communicate their ideas relevantly and coherently in writing.

Course outcomes: The proposed course to enable students to use 'good' English and perform the following:

- Gather ideas and information, to organize ideas relevantly and coherently.
- Engage in debates. Participate in group discussions.
  Face interviews. Write project/research reports/technical reports.
- Make oral presentations.
- Writing formal letters and to take part in social and professional communication.

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Demonstrate the usage of phonemes while referring to the dictionary	Understanding	PO5,PO9, PO10, PO12
CO2	Articulate with others by using proper functions.	Applying	PO5,PO9, PO10, PO12
CO3	Enact the roles with proper body language.	Applying	PO5,PO9, PO10, PO12
CO4	Communicate fluently with proper pronunciation	Analyzing	PO5,PO9, PO10, PO12

Unit-1: Pronouncing Words

Unit-2: Interaction 3

Unit-3: Stress & Intonation

Unit-4: Interaction 4

PRESCRIBED LAB MANUAL:

Speak Well-Orient Blackswan Publishers

SUGGESTED BOOKS/ MANUALS AND SOFTWARES:

1. Interact- Orient Blackswan
2. The Rosetta stone English Library
3. Language in Use
4. English in Mind

Course Code		L	T	P	Credits
1000171222	**ENGINEERING PHYSICS LAB**	0	0	3	2

(Any 8 of the following listed experiments)

Course Objectives:

- The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and fabricate engineering and technical equipment.
- Design of circuits using new technology and latest components and to develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.

Outcome:

- Hands on experience for all the instruments and better understanding of theory.

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Experimentation of laws of vibrations in strenteched string	Understanding	PO1,PO2, PO9, PO12
CO2	Determination of velocity of sound, rigidity modulus of a wire, acceleration due to gravity, radius of gyration and Planck's constant.	Applying	PO1, PO2, PO9, PO12
CO3	Analyze the voltage vs. current characteristics of Zener diode and temperature vs. resistance characteristics of a thermistor	Applying	PO1, PO2, PO9
CO4	Demonstration of formation Newton's rings, diffraction pattern using grating and induced magnetic field in a cirucuclar coil.	Analyzing	PO1, PO2, PO9

List of Experiments

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence.
2. Newton's rings –Radius of Curvature of Plano Convex Lens.
3. Determination of Rigidity modulus of a material- Torsional Pendulum.
4. Determination of Acceleration due to Gravity and Radius of Gyration- Compound Pendulum.
5. Melde's experiment – Transverse and Longitudinal modes.
6. Verification of laws of stretched string –Sonometer.
7. Determination of velocity of sound – Volume resonator.
8. L C R Senes Resonance Circuit.
9. Study of I/V Characteristics of Semi conductor diode.
10. I/V characteristics of Zenerdiode.
11. Thermistor characteristics – Temperature Coefficient.
12. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
13. Determination of wavelength of laser source using dirreractiong rating
14. Determination of Planck's constant using photocell.

Course Code	DATA STRUCTURES PROGRAMMING LAB	L	T	P	Credits
1000171228		0	0	3	2

Exercise1:

a) Write a C program to representation the given sparse matrix using arrays.

b) Write a C program to store a polynomial expression in memory using Arrays.

Exercise 2:

a) Write C program that implement stack (its operations) using arrays

b) Write C program that implement Queue (its operations) using arrays.

c) Write a C program that uses Stack operations to Convert in fix expression into post fix expression

Exercise 3:

a) Write a C program that uses functions to create a singly linked list

b) Write a C program that uses functions to perform insertion operation on a singly linked list

c) Write a C program that uses functions to perform deletion operation on a singly linked list

Exercise 4:

a) Write C program that implement Queue (its operations) using linked lists

b) Write C program that implement stack (its operations) using Linked list

Exercise 5:

a) Write C program that use both recursive and non recursive functions to perform Binary search for a Key value in a given list.

b) Write a C program to reverse elements of a single linked list.

c) Write a C program to store a polynomial expression in memory using linked list

Exercise 6:

a)Write C program that implement heap sort, to sort a given list of integers in ascending order

b) Write C program that implement merge sort, to sort a given list of integers in ascending order

Exercise 7:

Write a C program to create a Binary Tree of integers

Exercise 8:

a) Write a recursive C program for Traversing a binary tree in preorder, in order and post order.

b) Write a non recursive C program for Traversing a binary tree in preorder, in order and post order.

Exercise 9:

a) Write a C program to Create a BST

b) Write a C program to insert a node into a BST.

c) Write a C program to delete a node from a BST.

PROGRAM STRUCTURE

FOR

II-B.Tech

I & II-SEMESTERS

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
PROGRAM STRUCTURE

II Year- I Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1	1004172101	Electronic Devices and Circuits	3	1*	0	3
2	1004172102	Switching Theory and Logic Design	3	1*	0	3
3	1004172103	Signals and Systems	3	1*	0	3
4	1004172104	Electrical Technology	3	1*	0	3
5	1004172105	Random Variables and Stochastic Process	3	1*	0	3
6	1004172106	Mathematics-IV	3	1*	0	3
7	1004172121	Electronic Devices and Circuits Lab	0	0	3	2
8	1004172122	Networks & Electrical Technology Lab	0	0	3	2
		Total Credits:				22

II Year- II Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1	1004172201	Electronic Circuit Analysis	3	1*	0	3
2	1004172202	Control Systems	3	1*	0	3
3	1004172203	Electromagnetic Waves and Transmission Lines	3	1*	0	3
4	1004172204	Analog Communications	3	1*	0	3
5	1004172205	Pulse and Digital Circuits	3	1*	0	3
6	1099172207	Engineering Economics and Management Science	3	1*	0	3
7	1004172221	Electronic Circuit Analysis Lab	0	0	3	2
8	1004172222	Analog Communications Lab	0	0	3	2
9	1004172231	Industrial visit	0	0	0	2
Total Credits:						24

DETAILED SYLLABUS FOR

II-B.Tech

I-SEMESTER

Course Code		L	T	P	Credits
1004172101	ELECTRONIC DEVICES AND CIRCUITS	3	1	0	3

Course Overview:

The course provides a comprehensive understanding of electronic circuits and devices.

Course Objectives:

- To provide an overview of the principles, operation and application of the analog building blocks like diodes, BJT, FET etc for performing various functions.
- To provide the student with the basic knowledge about design, functionality and fabrication of semiconductor devices.
- Understanding of complex devices such as semiconductor diodes and field-effect transistors are modeled and how the models are used in the design and analysis of useful circuits.
- Capability to design circuits, take measurements of circuit behavior and their performance, compare with predicted circuit models and explain discrepancies.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Explain the basic concepts of semiconductor physics and summarize the characteristics of PN junction diode in different modes of operation.	Understand	PO-1, PO-2, PO-12
CO2	Compare the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.	Understand	PO-1, PO-2, PO-3
CO3	Summarize the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations and understand the various biasing techniques for BJT and FET.	Understand	PO-1, PO-2, PO-3
CO4	Explain the stabilization concepts with expressions and perform the analysis of small signal low frequency transistor amplifier circuits using BJT and FET in different configurations.	Understand	PO-1, PO-2, PO-3, PO-4, PO-10

Unit-I:

Semiconductor Physics:
Insulators, Semi conductors and Metals classification using energy band diagrams, mobility

and conductivity, electrons and holes in intrinsic semi conductors, extrinsic semi conductors, drift and diffusion, Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors
Junction Diode Characteristics: Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, Diode capacitance, energy band diagram of PN junction Diode.

Outcome:

Explain the basic concepts of semiconductor physics and summarize the characteristics of PN junction diode in different modes of operation

Activity/Event : Identification of Components
Unit-II:

Special Semiconductor Devices:

Zener Diode, Breakdown mechanisms, Zener diode applications, LED, LCD, Photo diode, Varactor diode, Tunnel Diode, SCR, UJT.
Rectifiers and Filters: Half wave rectifier, full wave rectifier, bridge rectifier, rectifier circuits-operation, filters; Inductor filter, Capacitor filter, L- section filter, π- section filter, comparison of various filter circuits in terms of ripple factors.
Outcome: Compare the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.

Activity/Event : Design various circuits using diodes

Unit-III:

Transistor Characteristics:

BJT: Junction transistor, transistor current components, transistor configurations, transistor as an amplifier, and characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, punch through/ reach through, Photo transistor,
FET: FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

Outcome: Summarize the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations and understand the various biasing techniques for BJT and FET.

Activity/Event: Build a circuit used for impedance matching circuit

Unit-IV: Transistor Biasing and Thermal Stabilization : Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in V_{BE}, I, and Stability factors, (S,S,S), compensation, Thermal runaway, Thermal stability, FET Biasing- methods and stabilization

Outcome:

Explain the stabilization concepts with expressions

Activity/Event : Design an amplifier

Unit-V:

Small Signal Low Frequency Transistor Amplifier Models: BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.
FET: Generalized analysis of small signal model, Analysis of CG,CSand CD amplifiers, and comparison of FET amplifiers.

Outcome:

Explain the stabilization concepts with expressions and perform the analysis of small signal low frequency transistor amplifier circuits using BJT and FET in different configurations.

Activity/Event : Design a low frequency amplifier

Text Books:

1.Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition.
2. Electronic Devices and Circuits-David A. Bell, Oxford University Press, Fifth Edition.

Reference Books:

1. Electronic Devices and Circuits- K. Satya Prasad.
2. Electronic Devices and Circuits-B.P. Singh, Rekha Singh, Pearson Publications, Second Edition.
3. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, Second Edition
4. Electronic Devices and Circuit Theory-R.L. Boylestad and Louis Nashelsky, Pearson Publications, Tenth Edition.
5. Electronic Devices and Circuits -B V Rao, KBR Murty, K Raja Rajeswari, PCR Pantulu, Pearson, 2nd edition.
6. Integrated Electronics- Jacob Millman, C. Halkies, C. D. Parikh, Tata Mc-Graw Hill, 2009.

Course Code	SWITCHING THEORY AND LOGIC DESIGN	L	T	P	Credits
1004172102		3	1	0	3

Course Overview:

Able to derive Boolean expressions and design combinational and sequential digital circuits.

Course Objectives:

This course provides in-depth knowledge of switching theory and the design techniques of digital circuits, which is the basis for design of any digital circuit. The main objectives are:

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To implement simple logical operations using basic gates and combinational logic circuits
- To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines
- To implement synchronous state machines using flip-flops.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Convert numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.	Understand, Apply	PO-1, PO-2, PO-3
CO2	Convert simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.	Understand, Apply	PO-1, PO-2, PO-3
CO3	Design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.	Analyze	PO-1, PO-2, PO-3
CO4	Design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.	Analyze	PO-1, PO-2, PO-3

Unit-I:

Number system and Boolean algebra and Switching functions:

Number system: Number Systems, Base Conversion Methods, Complements of Numbers, Codes- Binary Codes, Binary Coded Decimal Code and its Properties, Unit Distance Codes, Alphanumeric Codes, Error detecting and correcting methods

Boolean Algebra: Basic Theorems and Properties, principle of complementation & duality, De-morgan theorems, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates, Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR realizations.

Outcome:

Convert numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD**.**

Activity/Event: Verification of logic gates with 74 MSI series ICs on bread board.

Unit-II:

Minimization and Combinational Logic Circuits Design-I:

Introduction, The Minimization with theorem, The Karnaugh Map Method, Five and Six Variable Maps, Prime and Essential Implications, Don't Care Map Entries, Using the Maps for Simplifying, Tabular Method.

Combinational logic Circuits: Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders, 4-bit binary subtractor, adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit, look-a-head adder circuit.

Outcome:

Manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.

Activity/Event: Design and Implement Logic functions using Full and Half Adders

Unit-III :

Combinational Logic Circuits Design-II:

Design of decoder, demultiplexer, 7 segment decoder, encoder, multiplexer, multiplexing, realization of Boolean functions using decoders and multiplexers, priority encoder, Magnitude comparator.

Introduction of PLD'S: PROM, PAL, PLA-Basics structures, realization of Boolean function with PLDs, programming tables of PLDs, merits & demerits of PROM, PAL, PLA comparison.

Outcome:

Design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.

Activity/Event: Design and Implement Logic functions using Multiplexers

Unit-IV:

Sequential Circuits –I:

Classification of sequential circuits, Latches, basic flip-flops, truth tables and excitation tables (NAND RS latch, nor RS latch, RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals). Master-Slave Flip-flops, Conversion from one flip-flop to another type flip-flop. Counters, Design of asynchronous counters, Design of Synchronous Counters, Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.

Outcome:
To impart the concepts of sequential circuits enabling them to analyze sequential systems in terms state machines

Activity/Event: Design and Implement Logic function using Sequential Circuits.

Unit-V:
Sequential Circuits-II:

Finite state machine-capabilities and limitations, Mealy and Moore models, conversion of Melay to Moore model and vice-versa, analysis of clocked sequential circuits, state diagrams, state tables, reduction of state tables and state assignment, design procedures, Partition techniques.

Outcome:

Draw Finite State Machine for real time application.

Text Books:

1. Switching Theory and Logic Design by Hill and Peterson Mc-Graw Hill TMHedition.
2. Digital Design by Morris ManoPHI.

Reference Books:

1. Modern Digital Electronics by RP Jain, TMH
2. Switching Theory and Logic Design by A. An and Kumar
3. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers
4. Micro electronics by Milliman MH edition

Course Code	SIGNALS AND SYSTEMS	L	T	P	Credits
1004172103		3	1	0	3

Course Overview:

Signals and Systems is an introduction to analog and digital signal processing, a topic that forms an integral part of engineering systems in many diverse areas, including communications, speech processing, image processing, defense electronics, consumer electronics, seismic data processing, and consumer products.

Course Objectives:

- Understanding the fundamental characteristics of signals and systems.
- Understanding the concepts of vector space and orthogonal series.
- Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
- Developing the mathematical skills to solve problems involving filtering, modulation and sampling.
- Applying convolution both in time domain and frequency domain.
- Developing mathematical skills to solve differential and difference equation using Laplace transform and Z-transform

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Apply the knowledge of linear algebra topics like vector space and orthogonal basis to signals, Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.	Understand, Apply	PO-1, PO-2, PO-3
CO2	Understand the process of sampling and the effects of under sampling, Analyze system properties based on impulse response and Fourier analysis	Understand, Apply	PO-1, PO-2, PO-3
CO3	Apply convolution both in time domain and frequency domain.	Apply	PO-1, PO-2, PO-3
CO4	Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems.	Apply	PO-1, PO-2, PO-3

Unit-I:

SIGNAL ANALYSIS

Definition and classification of Signals and Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Complex exponential and sinusoidal signals, Singularity function and related functions: impulse function, unit step, ramp function.

Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions.

Outcome:

Apply the knowledge of linear algebra topics like vector space and orthogonal basis to signals.

Activity/Event: Generation and Operation of different standard signals(step, ramp, impulse, exponential etc..) using MATLAB

Unit-II:

Fourier Series & Fourier Transforms:

Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum.

Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform

Outcome:
Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.

Activity/Event: Observe Signal spectrum in frequency domain by using Fourier Analysis.

Unit-III:

Concept of Sampling & Signal Transmission Through Linear Systems:
Sampling theorem – Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling.

Linear system, Impulse response, Linear time invariant (LTI) system, Transfer functions of a LTI system, Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics.

Outcome:

- Understand the process of sampling and the effects of under sampling.
- Analyze system properties based on impulse response and Fourier analysis.

Activity/Event:

- Reconstruction of a signal from it's samples using MATLAB.
- Designing of LPF, HPF and BPF using MATLAB.

Unit-IV:

Convolution and Correlation of Signals:

Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property, Cross correlation and auto correlation functions, properties of cross correlation and auto correlation of functions, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation,

Outcome:

Apply convolution both in time domain and frequency domain.

Activity/Event:

- Perform signal filtering using convolution.
- Magnitude identification of a single frequency and a band of frequency.
- Obtain convolution result (both linear and circular) of two different sequence by using MATLAB Software

Unit-V:

Laplace Transforms & Z–Transforms:

Laplace Transforms: Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Relation between L.T's, and F.T. of a signal.

Z–Transforms: Fundamental difference between continuous-time and discrete-time signals, discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal, Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms

Outcome:

Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems.

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Activity/Event:

- Finding system response from characteristic equation by using L.T and Z.T (Using MATLAB AND LABVIEW Software).

Text Books:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.
3. Signals & Systems- Narayan Iyer and K SatyaPrasad ,Cenage Pub.

Reference Books:

1. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Edition.
2. Signals and Systems – K R Rajeswari
3. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.

Course Code	ELECTRICAL TECHNOLOGY	L	T	P	Credits
1004172104		3	1	0	3

Course Overview:

This course covers various topics related to principle of operation and performance of various electrical machines.

Course Objectives:

- To understand the principle of operation, constructional details and operational characteristics of DC generators.
- To understand the principle and characteristics of DC motors. To introduce starting and speed control methods of DC motors.
- To learn the principle of operation of transformers. Develop the equivalent circuit and evaluate the performance of transformers.
- To learn the principle of operation and constructional details of three phase induction motor. Study the torque – slip characteristics and starting methods of induction motor.
- To learn the principle of operation and constructional details of synchronous machines.
- To study the principle of operation of different types of Electrical Measuring instruments, Measurement of voltage, current and Power.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Explain the operation of DC generator, DC motor and analyze the characteristics of DC generator.	Understand, Analyze	PO-1, PO-2, PO-3
CO2	Develop equivalent circuit and evaluate performance of transformers	Apply	PO-1, PO-2, PO-3
CO3	Explain the Principle of operation of Induction motor and Synchronous machine and also explain the speed-torque characteristics and starting methods of induction motor	Understand	PO-1, PO-2, PO-3
CO4	Explain various Electrical Measuring instruments like Ammeter, Voltmeter, Wattmeter	Understand	PO-1, PO-2, PO-3

Unit-I:

DC Generators:

Principle of operation and construction of DC generators - EMF equation – types of generators – magnetization and load characteristics of DC generators.

Outcome:

Explain the operation of DC generator and analyze the characteristics of DC generator.

Activity/Event:

Cut the thermocol or thick paper sheets into the shape of armature core laminations and pole core laminations

Unit-II:

DC Motors:

Principle of operation – types of DC Motors – torque equation of DC motor –applications – three point starter – losses and efficiency – Swinburne's test – speed control of DC shunt motor – flux and Armature voltage control methods.

Outcome:

Explain the principle of operation, starting and speed control methods of DC motors.

Activity/Event:

Designing a shunt and series motor in Simulink and observe their characteristics

Unit-III:

Transformers :

Principle of operation of single phase transformer – types –phasor diagram on no-load and load – equivalent circuit, losses and efficiency of transformer - regulation of transformer – OC and SC tests – predetermination of efficiency and regulation.

Outcome:

Develop equivalent circuit and evaluate performance of transformers.

Activity/Event:

Design the ideal and non-ideal transformers in Simulink/ PSPICE and observe their characteristics under load and no load conditions.

Unit-IV:

Induction Machine:

Principle of operation and construction of three phase induction motors –slip ring and squirrel cage motors – slip-torque characteristics – efficiency calculation – starting methods.

Synchronous Machines:

Construction of synchronous machines, principle of operation of alternator and synchronous motor.

Outcome:

Explain the Principle of operation of Induction motor and Synchronous machine and also explain the speed-torque characteristics and starting methods of induction motor

Activity/Event:

Students will be divided into groups and every group need to give PPT on one of the topic.

Unit-V:

MEASURING INSTRUMENTS

Classification – Deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, Moving Iron type, wattmeter

Outcome:

Explain various Electrical Measuring instruments like Ammeter, Voltmeter, Wattmeter.

Activity/Event :

Draw the diagrams of ammeter , voltmeter, wattmeter on charts

Text Books:

1. Principles of Electrical Machines by V.K. Mehta &Rohit Mehta,S.Chand publications.
2. Theory & performance of Electrical Machines by J.B.Guptha, S.K.Kataria& Sons.
3. Electrical Technology by U.A. Bakshi& V. U. Bakshi

Reference Books:

1. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah,TMHPublications.
2. Fundamentals of Electrical Engineering by Rajendra Prasad, PHIPublications, 2nd edition.
3. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications,2nd edition.

Course Code		L	T	P	Credits
1004172105	RANDOM VARIABLES & STOCHASTIC PROCESSES	3	1	0	3

Course Overview:

Able to derive Boolean expressions and design combinational and sequential digital circuits.

Course Objectives:

- To introduce students to the basic methodology of random variables and probabilistic thinking and apply it to problems.
- To understand basic concepts of Probability theory and Random Variables, how to deal with multiple Random Variables.
- To understand the difference between time averages statistical averages.

To different types of noise and their behaviour

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Find Probability distribution and density functions for single and multiple random variables	Understand, Apply	PO-1, PO-2, PO-3
CO2	Evaluate Mean and variances of random signals.	Apply	PO-1, PO-2, PO-3
CO3	Find autocorrelation function of random process and Analyze the relationship between power density spectrum and auto correlation.	Analyzing	PO-1, PO-2, PO-3
CO4	Estimate the noise in the communication channels	Understand, Apply	PO-1, PO-2, PO-3

Unit-I:

The Random Variable:

Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties**.**

Outcome:

- Meaning of random variable and different types of the random variable.
- Find Probability distribution and density functions for single and multiple random variables.
- Different types of distribution and density functions and their properties.

Activity/Event:

Bring out the differences among different standard cumulative distribution and density functions and their practical significance

Unit-II:

Operation on one Random Variable – Expectations:

Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable.

Outcome:

- Finding mean and variances of random variable
- To transform one form of random variable to another random variable

Activity/Event:

Necessity of various operations that are performed on random variable and where it is required.

Unit-III :

Multiple Random Variables:

Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions.

Operations on Multiple Random Variables:

Joint Moments about the Origin, Joint Central Moments, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case.

Outcome:

- Finding moment generating function of multiple random variables
- Finding conditional density and learning their properties

Activity/Event:

How the practical behaviour of noise is related in terms of multiple random variables concept and how its characteristics are performed

Unit-IV:

RANDOM PROCESSES – TEMPORAL CHARACTERISTICS:

The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, Nth-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

Outcome:

- Finding autocorrelation
- Finding ergodicity

Activity/Event:

Explanation of the noise scenario with the help of Random process concept and how correlation can be used for analysis of noise characteristics

Unit-V:

Random Processes –Spectral Characteristics:

The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

Linear Systems with Random Inputs:

Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output, Effective Noise Temperature, Average Noise Figure.

Outcome:

- Relating correlation and power spectrum densities
- Modeling of different noise sources
- Finding noise parameters for cascaded networks

Activity/Event :

Analysis of linear system with random signal response and its practical significance.

Text Books:

1. Probability, Random Variables & Random Signal Principles, PeytonZ. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI, 4th Edition, 2002.
3. Random variables and stochastic processes, Dr.Y.Mallikarjuna Reddy

Reference Books:

1. Probability theory, Applications and Random processes-C.Ibe
2. Probability Theory and Stochastic Processes – B. PrabhakaraRao, Oxford University Press.
3. Statistical Theory of Communication, S.P.Eugene Xavier, New Age Publications, 2003
4. Probabilistic Methods of Signal & System Analysis, George R.Cooper, Clave D. McGillem, Oxford, 3rd Edition, 1999.
5. Probability and Random Processes with Applications to Signal Processing, Henry Stark and John W.Woods, Pearson Education, 3rd Edition

Course Code	MATHEMATICS -IV	L	T	P	Credits
1004172106		3	1	0	3

Course Overview:

To find solution for complex and special functions like Bessel function in channel estimation and to learn concepts like sampling distributions, random process and queuing model for signal analysis and population studies

Course Objectives:

1. The purpose of this course is to make students well conversant with complex variable functions.
2. To solve ordinary differential equations, complex analysis, sampling theory arising in science and engineering.
3. To introduce the basic probability tools and concepts this is useful in modeling, such as Markov models and queuing theory

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Find derivatives of complex functions and solutions for special functions	Understand, Apply	PO-1, PO-2, PO-3
CO2	Understand the analyticity, potential fields, residues and poles of complex potentials in field theory and electromagnetic theory.	Understand	PO-1, PO-2, PO-3
CO3	Solve for mean and variance for given samples, To apply basic probability techniques and models to analyze the performance of computer systems, and, in particular, of networks and queues	Apply	PO-1, PO-2, PO-3
CO4	To expose the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.	Understand	PO-1, PO-2, PO-3

UNIT I:

Functions of a Complex Variable:

Complex function, Real and Imaginary parts of Complex function, Limit ,Continuity and Derivative of complex function, Cauchy – Riemann equations, Analytic functions, Entire function, Singular point, Conjugate function, C – R equations in polar form, Harmonic functions, Milne –Thomson method, Simple applications to flow problems.

Outcome:

Find derivatives of complex functions and solutions for special functions

Activity/Event:

To Solve problem of laminar flow

UNIT II:

Special Functions:

Introduction, solution of Bessel's differential equation leading to $J_n(x)$-Bessel's function of first kind. Basic properties and orthogonality. Solution of Legendre's differential equation leading to $P_n(x)$-Legendre polynomials. Rodrigue's formula, problems

Outcome:

Understand the analyticity, potential fields, residues and poles of complex potentials in field theory and electromagnetic theory

Activity/Event:

To apply Bessel function in channel estimation

UNIT – III:

Sampling Distributions:

Introduction, Population and samples, Sampling distribution of mean for large and small samples (with known and unknown variance), proportion - Sampling distribution of sums and differences of means and differences. Point and interval estimators for means and proportions (for large and small samples), Maximum error.

Outcome:

Solve for mean and variance for given samples in signal processing and image processing applications.

Activity/Event:

To apply AWGN in analysis of signals

UNIT IV:

Markov Processes :
Markov process, Poisson process – Discrete parameter Marcov chain – Chapman - Kolmogorov equations – Limiting distributions, problems

Outcome:
To apply basic probability techniques and models to analyze the performance of computer systems, and, in particular, of networks and queues

Activity/Event:

To apply Marcov process in nueral logic network

UNIT V:

Queuing Models:
Introduction, Marcovian queues – Birth and Death processes – single and multiple server queueing models –Littless formula -Queues with finite waiting rooms.

Outcome:
To expose the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.

Activity/Event:
To apply Queue theory for population studies.

Text Books:
1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. S. D. Sharma: Operations Research, Theory, Methods & Applications Kedar Nath Ram Nath publications.
3. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
4. Ronald E Walpose, Raymand H MyresSharon,L Myers, Keying E Ye. Probability & Statics for engineers and Scientists. Pearson Publications

Reference Books:
1 N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers,7th Ed., 2010.
2 B.V.Ramana: "Higher Engineering M athematics" Tata McGraw-Hill, 2006.
3 H. K. Dass and Er. RajnishVerma: "Higher Engineerig Mathematics", S. Chand publishing, 1st edition, 2011.
4 Pipes and Harvill: “Applied Mathematics for Engineers and Physicists”. Ed 3. New Delhi. Tata McGraw Hill.
5 Trivedi. K S.,”Probability and Statistics with reliability, Queingnad Computer Science Applications”, John Wiley and Sons, 2nd Edition, 2002

Course Code	ELECTRONIC DEVICES AND CIRCUITS LAB	L	T	P	Credits
1004172121		0	0	3	2

Learning Objectives:

- To determine V-I characteristics of diode.
- To understand the diode application as HWR, FWR
- To analyze how the BJT is operated in three configurations.
- To understand how FET act as Voltage controlled device
- To operate BJT and FET as amplifier.
- To Determine the characteristics of UJT and SCR

Electronic Workshop Practice:

1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multi meter, Function Generator, Regulated Power Supply and CRO.

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

1. P-N Junction Diode Characteristics
   Part A: Germanium Diode (Forward bias& Reverse bias) Part B: Silicon Diode (Forward Bias only)
2. Zener Diode Characteristics Part A: V-I Characteristics
   Part B: Zener Diode as Voltage Regulator
3. Rectifiers (without and with c-filter) Part A: Half-wave Rectifier
   Part B: Full-wave Rectifier
4. BJT Characteristics(CE Configuration) Part A: Input Characteristics
   Part B: Output Characteristics
5. FET Characteristics(CS Configuration) Part A: Drain Characteristics
   Part B: Transfer Characteristics
6. SCR Characteristics
7. UJT Characteristics
8. Transistor Biasing
9. CRO Operation and its Measurements
10. BJT-CE Amplifier
11. Emitter Follower-CC Amplifier
12. FET-CS Amplifier

Learning Outcomes:

- Able to analyze how diode acts as open switch, close switch and ideal switch.
- Able to know the efficiency of various rectifiers with and without filters
- Able to analyze how BJT is operated in different regions such as amplifier etc.
- Able to calculate current values when transistor is operated as amplifier.
- Able to know how FET is operated in different regions

Course Code	NETWORKS &ELECTRICAL TECHNOLOGY LAB	L	T	P	Credits
1004172122		0	0	3	2

Learning Objectives:

- To determine resonance frequency, Q-factor of RLC network.
- To analysis time response of first orders RC/RL network for non-sinusoidal inputs.
- To estimate parameters of two port networks
- To understand the concept network theorems in network reduction of electrical networks.
- To determine efficiency of dc shunt machine with actual loading.
- To analyses performance of 3 phase induction motor
- To understand the significance of regulation of an alternators through synchronous impedance method.

PART – A

Any five experiments are to be conducted from each part

1. Series and Parallel Resonance – Timing, Resonant frequency, Bandwidth and Q-factor determination for RLC network.
2. Time response of first order RC/RL network for periodic non-sinusoidal inputs – time constant and steady state error determination.
3. Two port network parameters – Z,Y Parameters, chain matrix and analytical verification.
4. Verification of Superposition and Reciprocity theorems.
5. Verification of maximum power transfer theorem. Verification on DC, verification on AC with Resistive and Reactive loads.
6. Experimental determination of Thevenin's and Norton's equivalent circuits and verification by direct test.

PART – B

7. Magnetization characteristics of D.C. Shunt generator. Determination of critical field resistance.
8. Speed control of D.C. Shunt motor by Armature & flux control methods
9. Brake test on DC shunt motor. Determination of performance characteristics.
10. OC & SC tests on Single-phase transformer (Predetermination of efficiency and regulation at given power factorsand determination of equivalent circuit).
11. Brake test on 3-phase Induction motor (performance characteristics).
12. Regulation of alternator by synchronous impedance method

Learning Outcomes:

- Able to analyses RLC circuits and understand resonant frequency and Q-factor.
- Able to determine first order RC/RL networks of periodic non- sinusoidal waveforms.
- Able to apply network theorems to analyze the electrical network.
- Able to describe the performance of dc shunt machine.
- Able to investigate the performance of 1-phase transformer.
- Able to perform tests on 3-phase induction motor and alternator to determine their performance characteristics.

DETAILED SYLLABUS
FOR
II.B.TECH
II-SEMESTER

Course Code	ELECTRONIC CIRCUIT ANALYSIS	L	T	P	Credits
1004172201		3	1	0	3

Course Overview:

This course covers the basics you need to know when starting out with electronic circuits. The fundamentals of analysing DC electronic circuits are explained through the use of worked out examples. Circuit analysis, or solving a circuit, means figuring out voltages and currents in each element. Here's an overview of circuit analysis, with some context for the various tools and methods we use to analyze circuits.

Course Objectives:

- To develop the basic understanding of amplifier designing and its analysis using hybrid model
- To make students aware of amplifier operation at low and high frequency and its frequency responses.
- To make students learn about different types of feedback amplifiers and oscillators.
- To make students aware of Power amplifiers Class A, Class B, Class C, Class AB and other types of amplifiers are analyzed.
- To make students learn about different types of Tuned amplifiers.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Explain classification of amplifiers and analyze the CE, CB, CC amplifiers using small signal hybrid model and derive the voltage gain, current gain, input impedance and output impedance	Understand	PO-1, PO-2, PO-3
CO2	Design and analyze the cascaded RC coupled BJT amplifier and MOS Amplifier, single stage amplifiers and different types of the coupled amplifiers	Understand, Apply	PO-1, PO-2, PO-3
CO3	Design and analyze the different types of feedback amplifiers and oscillators	Analyzing	PO-1, PO-2, PO-3
CO4	Design and analyze different types of power amplifiers and learn the effects of cascading on single, double tuned amplifiers.	Analyzing	PO-1, PO-2, PO-3

Unit-I:

Small Signal High Frequency Transistor Amplifier models:

BJT: Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid π conductance's, Hybrid π capacitances, validity of hybrid π model, 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 and gain bandwidth product.

FET: Analysis of common Source and common drain Amplifier circuits at high frequencies.

Outcome: Explain classification of amplifiers and analyze the CE, CB, CC amplifiers using small signal hybrid model and derive the voltage gain, current gain, input impedance and output impedance.

Activity/Event:

Draw the high frequency of differential amplifier.

Unit-II:
Multistage Amplifiers :

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

Outcome: Design and analyze the cascaded RC coupled BJT amplifier and MOS Amplifier, single stage amplifiers and different types of the coupled amplifiers.

Activity/Event:

Draw the frequency response of multi stage amplifiers using bode plot.

Unit-III:
Feedback Amplifiers :

Feedback principle and concept, types of feedback, classification of amplifiers, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Method of analysis of feedback amplifiers.

Oscillators:
Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wein - bridge oscillators with BJT and FET and their analysis, Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators with BJT and FET and their analysis, Frequency and amplitude stability of oscillators.

Outcome: Design and analyze the different types of feedback amplifiers and oscillators

Activity/Event:
Investigate the performance of feedback amplifiers and oscillators in time domain and frequency domain.

Unit-IV:

Power Amplifiers: Classification of amplifiers, Class A power Amplifiers and their analysis, Harmonic Distortions, Class B Push-pull amplifiers and their analysis, Complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifier, Thermal stability and Heat sinks, Distortion in amplifiers.

Outcome: Design and analyze different types of power amplifiers

Activity/Event: Find out stability of various power amplifiers.

Unit-V:
Tuned Amplifiers :

Introduction, Q-Factor, small signal tuned amplifier, capacitance single tuned amplifier, double tuned amplifiers, effect of cascading single tuned amplifiers on band width, effect of cascading double tuned amplifiers on band width, staggered tuned amplifiers, stability of tuned amplifiers, wideband amplifiers

Outcome: Analyze the effects of cascading on single, double tuned amplifiers

Activity/Event: Discuss about various applications of tuned amplifiers

Text Books:

1. Integrated Electronics- J. Millman and C.C. Halkias, Tata Mc Graw-Hill,1972.
2. Electronic Circuit Analysis and Design – Donald A. Neaman, Mc GrawHill.

Reference Books:

1. Electronic Devices and Circuits- Salivahanan, N.Suressh Kumar, A. Vallavaraj, TATA McGraw Hill, Second Edition
2. Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, TenthEdition.
3. Electronic Circuit Analysis-B.V.Rao, K.R.Rajeswari, P.C.R.Pantulu,K.B.R.Murthy, Pearson Publications.
4. Microelectronic Circuits-Sedra A.S. and K.C. Smith, Oxford University Press, Sixth Edition.

Course Code	CONTROL SYSTEMS	L	T	P	Credits
1004172202		3	1	0	3

Course Overview:

This course shall introduce the fundamentals of modeling and control of linear time invariant systems; primarily from the classical viewpoint of Laplace transforms and a brief emphasis on the state space formulation as well. The course will be useful for students from major streams of engineering to build foundations of time/frequency analysis of systems as well as the feedback control of such systems. Students acquire a range of intellectual skills that cover the design, analysis and simulation of control systems

Course Objectives:

- To introduce the concepts of open loop and closed loop systems, mathematical models of mechanical and electrical systems, and concepts of feedback.
- To study the characteristics of the given system in terms of the transfer function and introducing various approaches to reduce the overall system for necessary analysis.
- To develop the acquaintance in analyzing the system response in time-domain and frequency domain in terms of various performance indices.
- To analyze the system in terms of absolute stability and relative stability by different approaches.
- To design different control systems for different applications as per given specifications.
- To introduce the concepts of state variable analysis, design and also the concepts of controllability and Observability.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Understands the concepts of feedback and its advantages to various control systems	Understand	PO-1, PO-2, PO-3
CO2	Understand the characteristics of the given system in terms of the transfer function and introducing various approaches to reduce the overall system for necessary analysis	Understand, Apply, Analyzing	PO-1, PO-2, PO-3
CO3	Analyze the system in terms of absolute stability and relative stability by different approaches.	Analyzing	PO-1, PO-2, PO-3
CO4	In addition to the conventional approach, the state space approach for the analysis of control systems is also introduced	Understand, Apply	PO-1, PO-2, PO-3

Unit-I:

Introduction:

System Control System, Open Loop Control System, Closed loop Control System, Different Examples Meaning of the terms reference input, control input, disturbance input and controlled output. Mathematical models of Physical Systems. Differential equations of physical systems, Transfer functions, Block diagram Algebra, Signal flow graphs with illustrative examples. Effects of Feedback

Feedback Characteristics and its advantages, linear zing effect of feedback.

Outcome:

This course introduces the concepts of feedback and its advantages to various control systems.

Activity/Event :

Find the transfer function of servomotors and represent them in block diagrams and signal flow graphs.

Unit-II:

Time Response Analysis:

Standard test Signals, Time response of first and second order systems, steady state errors and error constants, Effect of adding a zero to a system, Design specifications of second order systems, Performance indices.

Introduction to Design:

The design problem, Preliminary consideration of classical design, Realization of basic Compensators, Cascade compensation in time domain and frequency domain, PID controllers

Outcome:

The performance metrics to design the control system in time-domain are introduced. Control systems for various applications can be designed using time-domain analysis.

Activity/Event :

Analyze the time domain response of various compensators and controllers

Unit-III:
Concepts of Stability and Algebraic Criteria

The concept of Stability, Necessary Conditions for Stability, Routh-Hurwitz Stability Criterion, Relative stability analysis,

The Root Locus Technique:

Introduction, The Root Locus concepts, Construction of Root Loci

Outcome:

This course introduces the concepts of absolute stability and relative and methods to find out stability.

Activity/Event: Find the stability of operational amplifier.
Unit-IV:

Frequency response analysis

Introduction, Correlation between time and frequency response, Polar Plots, Bode Plots, Nyquist Stability Criterion. - Constant M and N Circles - Nichol's Chart - Use of Nichol's Chart in Control System Analysis.

Outcome:

The performance metrics to design the control system in frequency-domain are introduced. Control systems for various applications can be designed using frequency-domain analysis.

Activity/Event:

Draw the frequency response of differential amplifier using bode plot .

Unit-V:

State Variable Analysis and Design

Introduction, Concepts of State, State Variables and State models, State models for linear continuous-time systems, State variables and linear discrete-time systems, Diagonalization, Solution of state equations and Concepts of Controllability and Observability.

Outcome:

In addition to the conventional approach, the state space approach for the analysis of control systems is also introduced.

Activity/Event:

Find the state model of series and parallel resonance circuits.

Text Books:

1. Katsuhiko Ogata, "Modern Control Engineering," Pearson, Fifth Edition.
2. I.J.Nagarath and M.Gopal, " **Control System Engineering,"** New Age International publishers, Fifth Edition

Reference Books:

1. S. Salivahanan, R. Rengaraj, and G. R. Venkata Krishnan, " Control Systems Engineering," Pearson, First Impression
2. Benjamin C. Kuo, Frarid Golnaraghi, " Automatic Control Systems," Wiley Student Edition, Eigth Edition
3. Padma Raju and Reddy, "Instrumentation and Control Systems ", McGrawHill Education, 2016

Course Code		L	T	P	Credits
1004172203	**ELECTROMAGNETIC WAVES AND TRANSMISSION LINES**	3	1	0	3

Course Objectives:

The main objectives of this course are to understand:

- Fundamentals of steady electric and magnetic fields using various laws
- The concept of static and time varying Maxwell equations and power flow using pointing theorem
- Wave characteristics in different media for normal and oblique incidence
- Various concepts of transmission lines and impedance measurements

Course Outcomes:

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Analyze the Maxwell's Equations for static and time varying field	Understand, Apply	PO-1, PO-2, PO-3
CO2	Analyze the EM wave equation and explain the different types of polarization	Understand, Apply	PO-1, PO-2, PO-3
CO3	Explain the transmission line	Understand	PO-1, PO-2, PO-3
CO4	Explain the smith chart for solving the transmission line problem	Understand	PO-1, PO-2, PO-3

Unit-I:

Review of Co-ordinate Systems, **Electrostatics:**

Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.

Outcome: Analyzethe Maxwell's equation in static and time varying field.

Activity/Event:

Find the electric field intensity due to various charge distributions and verify it with the gauss law

Unit-II:

Magneto Statics :

Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Inductances and Magnetic Energy. Illustrative Problems**.**

Maxwell's Equations (Time Varying Fields):

Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces. Illustrative Problems.

Outcome: Analyze the Maxwell's equation in static and time varying field.

Activity/Event: Seminar Boundary conditions for electrostatics and magneto statics.

Unit-III:

EM Wave Characteristics - I:

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types. Illustrative Problems. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Poynting Vector and Poynting Theorem – Applications, Power Loss in a Plane Conductor. Illustrative Problems.

Outcome: Analyze the EM Wave equation in explain the different types of Polarization.

Activity/Event: Difference between the uniform plane wave and plane wave which is travelling in arbitrary direction

Unit-IV:

Transmission Lines - I :

Types, Parameters, T&π Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Loading - Types of Loading. Illustrative Problems.

Outcome: Explain the transmission Line

Activity/Event: Different types of transmission line and importance of characteristic impedance, group and phase velocities

Unit-V:

Transmission Lines – II:

Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. Low loss radio frequency lines and UHF Transmission lines, UHF Lines as Circuit Elements; Impedance Transformations λ/4, λ /2, λ/8 Lines –. Smith Chart – Construction and Applications, Quarter wave transformer, Stub Matching-single & double, Illustrative Problems.

Outcome:

Explain the Smith Chart for solving Transmission Line problems

Activity/Event: Different types of impedance matching techniques using smith chart and comparison with the traditional approach for loss less line.

Text Books:

1. Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.

Reference Books:

Electromagnetic Fields and Wave Theory –GSN Raju, Pearson Education 2006

1. Engineering Electromagnetics:Nathan Ida, Springer(India)Pvt.Ltd., New Delhi, 2nd ed., 2005.
2. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, TMH, 7th ed., 2006.
3. Electromagnetic Field Theory and Transmission Lines: G SasiBhushanaRao,Wiley India 2013
4. Transmission Lines and Networks–Umesh Sinha,SatyaPrakashan (Tech. India
5. Publications), New Delhi, 2001.
6. Electromagnetic waves and transmission lines – R S Rao, PHI, EEE edition

Course Code	ANALOG COMMUNICATIONS	L	T	P	Credits
1004172204		3	1	0	3

Course Overview:

Students can able to understand importance of modulation and various modulation techniques and necessary circuits at the transmitters and receivers .and importance of multiplexing techniques.

Course Objectives:

1. Familiarize with the fundamentals of analog communication systems.
2. Familiarize with various techniques for analog modulation and demodulation of signals.
3. Distinguish the figure of merits of various analog modulation methods.
4. Develop the ability to classify and understand various functional blocks of radio transmitters and receivers.
5. Familiarize with basic techniques for generating and demodulating various pulse modulated signals.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Differentiate various Analog modulation and demodulation schemes and their spectral characteristics	Understand	PO-1, PO-2, PO-3
CO2	Analyze noise characteristics of various analog modulation methods	Understand	PO-1, PO-2, PO-3
CO3	Analyze various functional blocks of radio transmitters and receivers	Understand	PO-1, PO-2, PO-3
CO4	Design simple analog systems for various modulation techniques.	Understand	PO-1, PO-2, PO-3

Unit-I:

Introduction to communication system, Need for modulation, Frequency Division Multiplexing , Amplitude Modulation, Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, square law Modulator,

Switching modulator, Detection of AM Waves; Square law detector, Envelope detector. **:** Double side band suppressed carrier modulators, time domain and frequency domain description, Generation of DSBSC Waves, Balanced Modulators, Ring Modulator, Coherent detection of DSB-SC Modulated waves, COSTAS Loop

Outcome:

Differentiate various Analog modulation and demodulation schemes and their spectral characteristics

Activity/Event: Explain about the need for modulation and its real time applications.

Unit-II:

Introduction to Hilbert Transform**,** Frequency domain description, Frequency discrimination method for generation of AM SSB Modulated Wave, Time domain description, Phase discrimination method for generating AM SSB Modulated waves. Demodulation of SSB Waves, Vestigial side band modulation: Frequency description, Generation of VSB Modulated wave, Time domain description, Envelope detection of a VSB Wave pulse Carrier, Comparison of AM Techniques, Applications of different AM Systems.

Outcome:

Differentiate various Analog modulation and demodulation schemes and their spectral characteristics

Activity/Event: Explain about the various modulation techniques and its applications.

Unit-III:

Angle Modulation:

Basic concepts, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM.

Outcome: Differentiate various Analog modulation and demodulation schemes and their spectral characteristics.

Activity/Event: Explain about the types of angle modulation and demodulation techniques.

Unit-IV:

Receivers: Radio Receiver :

Receiver Types - Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Comparison with AM Receiver, Amplitude limiting.

Pulse Modulation :

Time Division Multiplexing,, Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation & demodulation of PWM, PPM, Generation and demodulation of PPM, TDM Vs FDM

Outcome: Analyze various functional blocks of radio transmitters andreceivers

Activity/Event: Explain about various types of radio receivers with necessary circuits.

Unit-V:

Noise : Review of noise and noise sources, noise figure**,** Noise in Analog communication Systems, Noise in DSB& SSB System, Noise in AM System, Noise in Angle Modulation Systems, Threshold effect in Angle Modulation System, Pre-emphasis & de-emphasis

Outcome: Analyze noise characteristics of various analog modulation methods

Activity/Event: Calculate the noise characteristics of DSB & SSB communication systems.

Text Books:

1. Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe, TMH, 2007 3rdEdition.
2. Communication Systems – B.P. Lathi, BS Publication,2006.

Reference Books:

1. Principles of Communication Systems - Simon Haykin, John Wiley, 2ndEd.,.
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH2004.
3. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH,2007.
4. Fundamentals of Communication Systems - John G. Proakis, Masond, Salehi PEA,2006.
5. Electronic Communication systems – Tomasi,Pearson.

Course Code	PULSE AND DIGITAL CIRCUITS	L	T	P	Credits
1004172205		3	1	0	3

Course Overview:

This is the basic course for electronic engineers to understand the behaviour of active and passive devices and circuit configurations used for the generation and processing of pulse, digital and switching waveforms. These non-sinusoidal signals find extensive application in fields such as computers, control systems, counting and timing systems, data-processing systems, digital instrumentation, pulse communication, radar, telemetry, television and in many areas of experimental research

Course Objectives:

1. To understand the concept of wave shaping circuits, Switching Characteristics of diode and transistor.
2. To study the design and analysis of various Multi vibrators.
3. To understand the functioning of different types of time-base Generators.
4. To learn the working of logic families & Sampling Gates

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Design linear and non-linear wave shaping circuits	Understand, Apply	PO-1, PO-2, PO-3
CO2	Apply the fundamental concepts of wave shaping for various switching and signal generating circuits	Understand, Apply	PO-1, PO-2, PO-3
CO3	Design different multi vibrators and time base generators	Understand	PO-1, PO-2, PO-3
CO4	Utilize the non sinusoidal signals in many experimental research areas	Understand	PO-1, PO-2, PO-3

Unit-I:
Linear Wave Shaping:

High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square and ramp inputs. RC network as differentiator and integrator, attenuators, its applications in CRO probe, RL and RLC circuits and their response for step input, Ringing circuit

Outcome:

Design linear wave shaping circuits

Activity/Event: study and analyze linear wave shaping circuits such as R-C and R-L-C transient circuits

Unit-II:

Non-Linear Wave Shaping:

Diode clippers, Transistor clippers, clipping at two independent levels, Transfer characteristics of clippers, Emitter coupled clipper, Comparators, applications of voltage comparators, clamping operation, clamping circuits using diode with different inputs, Clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, Transfer characteristics of clampers

Outcome:

Design non-linear wave shaping circuits

Activity/Event:

study and analyze non-linear wave shaping circuits such as clippers, clampers and comparators

Unit-III:

Switching Characteristics of Devices:

Diode as a switch, piecewise linear diode characteristics, Transistor as a switch, Break down voltage consideration of transistor, saturation parameters of Transistor and their variation with temperature, Design of transistor switch, transistor- switching times.

Digital Logic gate circuits:

Realization of Logic Gates using DTL, TTL, ECL and CMOS logic circuits, Comparison of logic families

Outcome:

Apply the fundamental concepts of wave shaping for various switching and signal generating circuits

Activity/Event: study the switching characteristics of diode, transistor and realize logic gates using diodes and transistors

Unit-IV:
Multi vibrators:
Bistable Multi Vibrator: Analysis and Design of Fixed Bias, Self Bias Bistable Multi Vibrator, Collector catching Diodes, Commutating Capacitors, Methods of Triggering using RC network & Diode, Emitter Coupled Bistable Multi Vibrator (Schmitt trigger).

Monostable Multi Vibrator: Analysis and Design of Collector Coupled Mono stable Multi Vibrator, Triggering method of a Monostable Multi Vibrator, Application of Monostable Multi Vibrator as a Voltage to Time Converter.

Astable Multi Vibrator: Analysis and Design of Collector Coupled Astable Multi vibrator Application of Astable Multi Vibrator as a Voltage to Frequency Converter. All circuits are transistor version.

Outcome:
Design different multi vibrators

Activity/Event: Design and analyze various multi vibrators using transistors

Unit-V:

Voltage Time Base Generators& Sampling Gates:
General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators – basic principles, Transistor miller time base generator, Transistor Bootstrap time basegenerator

Sampling Gates:
Basic operating principles of sampling gates, Unidirectional and Bi- directional sampling gates, Reduction of pedestal in gate circuits, Applications of sampling gates.

Outcome: Utilize the non sinusoidal signals in many experimental research areas

Activity/Event:
Design and analyze time base generators and study the operating principles of various sampling gates

Text Books:

1. Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, Mothiki S Prakash Rao McGraw-Hill, Second Edition,2007.

Reference Books:

1. Pulse and Digital Circuits – A. Anand Kumar, PHI,2005
2. Pulse and Digital Circuits – Prof.B.N.Yoga Narasimhan
3. Solid State Pulse circuits - David A. Bell, PHI, 4th Edn.,2002
4. Pulse & Digital Circuits by Venkata Rao, K,Ramasudha K, Manmadha Rao,G.,Pearson,2010

Course Code		L	T	P	Credits
1099172207	**ENGINEERING ECONOMICS AND MANAGEMENT SCIENCE**	3	1	0	3

Course Overview:

The present course is designed in such a way that it gives an overview of concepts of Managerial Economics and Management Science. Managerial Economics enables students to understand micro environment in which markets operate how price determination is done under different kinds of competitions. Break Even Analysis is very helpful to the Business Concern for Decision Making, controlling and forward Strategic Planning. This course is also intended to familiarize the students with the framework for the managers and leaders available for understanding and making decisions relating to organizational structure, Production, Marketing, Human resource management and Project Management.

Course Objectives:

1. Understand the concepts of Managerial Economics and Management Science
2. Acquire the knowledge on the production theories and costs while dealing with the production and factors of production.
3. Aware about various types of business organizations and business cycles
4. To provide conceptual knowledge on functional management and Inventory Control Techniques
5. To gain basic knowledge about Project Management

Course Outcomes:

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Describe the concepts of managerial economics like Demand, Law of Demand, Determinants of demand and demand forecasting techniques	Understand	PO-1, PO-2, PO-8, PO-10, PO-11,PO-12
CO2	Express production functions of different variables	Understand	PO-1, PO-2, PO-8,PO-10,PO-11,PO-12
CO3	Evaluate various forms of business organizations, Acquire the knowledge on Functional management	Analyzing	PO-1, PO-2, PO-8,PO-10,PO-11,PO-12
CO4	Construct network diagram and solve problems of PERT and CPM	Analyzing	PO-1, PO-2, PO-8,PO-10,PO-11,PO-12

Unit-I:

Introduction to Managerial Economics and Markets:

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand-

Law of Demand and its limitations - Demand forecasting and Methods of forecasting. Introduction to Markets, Types of Market Structures, Pricing Methods

Outcome:

1. Describe the economic activities performed by the businessmen in the business for profit earning. Understand the significance of demand, its analysis, measurement of demand and its Forecasting

Activity/Event: Presentations and object oriented tests

Unit-II:

Production and Cost Analyses:

Concept of Production, Production Function - Law of Variable proportions - Isoquants and Isocosts and choice of least cost factor combination - Concepts of Returns to scale. Different cost concepts: opportunity costs, explicit and implicit costs- Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point (simple problems)

Outcome: Evaluate the production theories and pricing policies of various enterprises

Activity/Event: Presentations and object oriented tests

Unit-III:

Part 1: Types of Business Organization and Business Cycles:

Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises – Business Cycles: Meaning and Features – Phases of Business Cycle.

Part 2:Introduction to Management:

Concept –nature and importance of Management –Functions of Management – Henry Fayol 14 principles of management – F W Taylor scientific management theory - Maslow's theory of motivation – Decision making process - Concept of Leadership and Leadership Styles

Outcome: Take decisions using business cycles and explain concepts of management

Activity/Event: Case study on motivation

Unit-IV:

Functional Management:

Concept of HRM, HRD and PMIR- Functions of HR Manager– Job Evaluation and Merit Rating - Marketing Management- Functions of Marketing – Marketing strategies based on product Life Cycle, Channels of distributions. Operationalizing change through performance management – Plant Location, Plant Layout and Types – Inventory Control Techniques (EOQ & ABC) with problems.

Outcome: Explain concept of Hrm, Marketing Management

Activity/Event: Group discussion

Unit-V:

Part 1: Project Management: (PERT/CPM): Development of Network - Difference between PERT and CPM - Identifying Critical Path- Probability- Project Crashing (Simple Problems)

Part 2: Contemporary Management Practice: Basic concepts of MIS, MRP, Justin-Time (JIT) system, Enterprise Resource Planning (ERP)

Outcome: Analyze concepts of project management, Explain contemporary issues

Activity/Event : SWOT analysis

Text Books:

1. Varshney & Maheswari, "Managerial Economics", Sulthan Chand Publishers, 1st Revised Edition, 2009.
2. Dr. P. Vijaya Kumar &Dr. N. Appa Rao, '*Management Science'* Cengage, Delhi, 2012.

Reference Books:

1. D.N. Dwivedi, "Managerial Economics", Vikas Publication House Pvt.Ltd, 2nd Edition, 2012.
2. J.V.Prabhakar Rao & P.V.Rao, "Managerial Economics & Financial Analysis", Maruthi Publishers, 1st Revised Editon, 2011.
3. M.Kasi Reddy & Saraswathi, "Managerial Economics and Financial Analysis", PHI Publications, New Delhi, 10th Revised Edition, 2012.
4. Varshney & Maheswari, "Managerial Economics", Sulthan Chand Publishers, 1st Revised Edition, 2009.
5. Dr. P. Vijaya Kumar &Dr. N. Appa Rao, '*Management Science'* Cengage, Delhi, 2012.
6. Dr. A. R. Aryasri, *Management Science'* TMH 2011.
7. Koontz &Weihrich: 'Essentials *of management'* TMH 2011
8. Seth & Rastogi: Global Management Systems, Cengage learning , Delhi, 2011
9. Robbins: Organizational Behaviour, Pearson publications, 2011
10. Kanishka Bedi: Production & Operations Management, Oxford Publications, 2011
11. Philip Kotler & Armstrong: Principles of Marketing, Pearson publications
12. Biswajit Patnaik: Human Resource Management, PHI, 2011

Course Code		L	T	P	Credits
1004172221	**ELECTRONIC CIRCUIT ANALYSIS LAB**		0	3	2

0

Course Overview:

Obtain and analyze working characteristics of different amplifiers and oscillators

Course Objectives:

- To make the students learn about designing the electronic circuits of different kinds of amplifiers and oscillators using BJT,MOS transistors
- To make the students analyze these electronic circuits
- To make the students to perform the simulation of designed circuit using Multisim/ Equivalent Industrial Standard Licensed simulation software tool**.**

Course Outcomes:

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

- Outline the concepts of various electronic components and devices.
- Determine the frequency response of BJT and JFETs amplifiers.
- Verify different configurations of feedback amplifiers and measure A_V,A_I,R_I,R_O
- Design and analyze RC, LC oscillator circuits. Compute bandwidth and impedances of various amplifiers

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

1. Determination of f_T of a given transistor.
2. Voltage-Series Feedback Amplifier
3. Current-Shunt Feedback Amplifier
4. RC Phase Shift/Wien Bridge Oscillator
5. Hartley/Colpitt's Oscillator
6. Two Stage RC Coupled Amplifier
7. Darlington Pair Amplifier
8. Bootstrapped Emitter Follower
9. Class A Series-fed Power Amplifier
10. Transformer-coupled Class A Power Amplifier
11. Class B Push-Pull Power Amplifier
12. Complementary Symmetry Class B Push-Pull Power Amplifier
13. Single Tuned Voltage Amplifier
14. Double Tuned Voltage Amplifier

Course Code	**ANALOG COMMUNICATIONS LAB**	**L**	**T**	**P**	**Credits**
1004172222		**0**	**0**	**3**	**2**

Course Overview:

Obtain and analyze the characteristics of amplitude and angle modulation techniques in both software and hardware

Course Objectives:

1. To learn characteristics of modulation and demodulation techniques using simulation and hardware.
2. To perform frequency domain analysis
3. To learn characteristics of pulsed modulation and demodulation techniques using simulation and hardware

Course Outcomes:

- Design and verify linear modulation& demodulation systems using simulation and hardware.
- Design and verify non-linear modulation & demodulation systems using simulation and hardware.
- Demonstrate the characteristics of various functional blocks of Receiver.
- Analyze signal degradation in the channel at high frequencies through Pre-emphasis and De-emphasis.
- Demonstrate Frequency domain signal Analysis using Spectrum analyzer.

List of Experiments (Twelve experiments to be done-

The students have to calculate the relevant parameters) –

(a. Hardware, b. MATLAB Simulink, c. MATLAB Communication tool box)

1. Amplitude Modulation - Mod. & Demod.
2. AM - DSB SC - Mod. & Demod.
3. Spectrum Analysis of Modulated signal using Spectrum Analyser
4. Diode Detector
5. Pre-emphasis & De-emphasis
6. Frequency Modulation - Mod. & Demod
7. AGC Circuits
8. Sampling Theorem
9. Pulse Amplitude Modulation - Mod. & Demod.
10. PWM , PPM - Mod. & Demod.
11. PLL
12. Radio receiver characteristics.

Equipments & Software required:

1. Computer Systems with latest specifications.

2. Connected in LAN (Optional).
3. Operating system (Windows XP).
4. Simulations software (Simulink & MATLAB)
5. RPS - 0 – 30 V
6. CRO - 0 – 20 M Hz.
7. Function Generators - 0 – 1 MHz
8. Components
9. Multimeters
10. Spectrum Analyser

PROGRAM STRUCTURE

FOR

III-B.Tech

I & II SEMESTERS

III Year- I Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1	1004173101	Linear IC Applications	3	1*	0	3
2	1004173102	Digital Communications	3	1*	0	3
3	1004173103	Computer Architecture and Organization	3	1*	0	3
4	1004173104	Digital IC Applications	3	1*	0	3
5	1004173105	Antennas and Wave Propagation	3	1*	0	3
6	1004173121	Integrated Circuits/Pulse and digital circuits Lab	0	0	3	2
7	1004173122	Digital Communications Lab	0	0	3	2
8	1004173123	Digital IC Applications Lab	0	0	3	2
9	1099172103	Professional Ethics & Human Values	3*	0	0	0
Total Credits						**21**

III Year- II Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1	1004173201	Microprocessors and Microcontrollers	3	1*	0	3
2	1004173202	Communication Networks	3	1*	0	3
3	1004173203	VLSI design	3	1*	0	3
4	1004173204	Digital Signal Processing	3	1*	0	3
5	**Open Elective-I**					
	1005173206	e) Introduction to Data Base Management systems	3	1*	0	3
	1005173207	f) Introduction to Python Programming				
	1005173208	g) JAVA Programming				
	1004173205	h) Soft Computing Techniques				
	1004173206	e) Bio medical Instrumentation				
6	**Open Elective-II (CBCS)(MOOCs)**					
	1004173291	*Any available online course approved by department committee at the time of semester commencement	3	1*	0	3
7	1004173221	Microprocessors and Microcontrollers Lab	0	0	3	2

8	1004173222	VLSI Lab	0	0	3	2
9	1004173223	Digital Signal Processing Lab	0	0	3	2
Total Credits						**24**

S.No.	Course Code	Course Title	L	T	P	Credits
10	1004173241	Industry Oriented Mini Project	0		0	2

DETAILED SYLLABUS

FOR

I-B.Tech

I & II SEMESTERS

Course Code		L	T	P	Credits
1004173101	**LINEAR IC APPLICATIONS**	3	1	0	3

Course Overview:

To provide an over view of principles and applications of different Linear Integrated Circuits.

Course Objectives:

- To understand the basic operation of differential amplifiers with different modes.
- To understand & learn the electrical characteristics of Op -Amp.
- To learn the linear and non-linear applications of operational amplifiers.
- To understand the analysis & design of different types of active filters using Op-Amp.
- To learn the internal structure and operation of different analog to digital and digital to analog converters.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Understand basic operation and characteristics of op-amp.	Understand	PO-1, PO-2, PO-12
CO2	Interpret different linear and non-linear applications of Op-Amp.	Apply	PO-1, PO-2, PO-3
CO3	Design & analyze different types of active filters using Op-Amp.	Analyze	PO-1, PO-2, PO-3, PO-4, PO-10
CO4	Compare different types of ADC and DACs	Evaluate	PO-1, PO-2, PO-3, PO-4, PO-10

Unit-I:

Integrated Circuits: Block diagram of Operational amplifier, Differential Amplifier- DC analysis, AC analysis of different types of configurations of differential amplifier (Double Input/output, Single Input/output), Cascaded differential amplifier and level Translator.

Outcome:

- Summarize the characteristics of ICs
- Demonstrate the basic concepts of differential amplifier and its use in IC design.

Activity/Event:

Output signal verification of differential amplifier in common mode and differential mode of operations.

Unit-II:

Characteristic of Op-Amp : Inverting and Non-inverting amplifier, Ideal and practical characteristics of Op-Amps, DC and AC characteristics, Op-amp parameters & measurement(Input & Output off set voltages & currents, slew rate , CMMR, PSRR) Frequency compensation techniques.

Outcome:

- Summarize the electrical characteristics of Op-Amps and Its Parameters.
- Describe the operation and application of IC 741 Op-Amp.

Activity/Event:
Measurement of various parameters of Op-Amp practically.

Unit-III:

Applications of Op-Amp:
Linear Applications: Summing, scaling and averaging amplifiers, Integrator and differentiator, difference amplifier, Instrumentation amplifier, V to I and I to V converters.
Non – Linear Applications Comparator, Schmitt Trigger, AC amplifier, multi vibrators, function generator, log amplifier and anti-log amplifiers, precision rectifiers (Half-wave and full-wave rectifiers).

Outcome:

- Differentiate the Linear and Non-Linear applications of Op-Amp.
- Design circuits using operational amplifiers for various linear and non-linear applications.

Activity/Event:
Assignment to draw and describe the different configurations of Op-Amp in various linear and non linear applications.
Unit-IV:

Active Filters and Timers: Design & Analysis of Butterworth Active Filters – 1^{st} order, 2^{nd} order LPF HPF filters. Band – Pass, Band – reject and all – pass filters.
Timers: Functional Block diagram of IC 555, applications of IC 555 (Monostable multivibrator and Astable multi vibrator). VCO – IC 566, PLL –IC 565
Outcome:

- Design and analysis of different Filters and its use in design of different ICs.
- Analyze the function of 555 timer for various applications.

Activity/Event:

Find the frequency response of different filters and Check the Astable and Monostable multi vibrator operation using 555 timer

Unit-V:

DAC &ADC Converters

DAC Converters: Introduction, Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, and IC 1408 DAC.

ADC Converters: Introduction, parallel comparator, Counter type ADC, successive approximation ADC and dual slope ADC.

Outcome:

- Analyze the different types ADCs and DACs and its use.

Activity/Event:

- Generation of Analog signal using DAC and Generation of Digital signal using ADC.

Text Books:

1. Linear Integrated Circuits – D. Roy Chowdary, New Age International (P) Ltd, 2nd edition, 2003.
2. Op-Amp and Linear IC's – Ramakanth A Gayakwad, PHI, 4th edition, reprint 2000.

Reference Books:

1. Operational Amplifiers & Linear Integrated Circuits, Sanjay Sharma, SK Kataria&Sons, 2nd Edition, 2010.
2. Operational Amplifiers & Linear Integrated Circuits, R.F.Coughlin& Fredrick Driscoll, PHI, 6th Edition, reprint 2007.

Course Code		L	T	P	Credits
1004173102	**DIGITAL COMMUNICATIONS**	3	1	0	3

Course Overview:

This course gives complete knowledge about various digital modulation techniques and various digital carrier modulation techniques. In this course students can also study various encoding and decoding methods.

Course Objectives:

- To have a detailed study of various digital modulation and demodulation techniques
- To have a thorough knowledge of various error correction and detection schemes.
- To know about the probability of error calculation at the receiver of digital communication systems

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Understand the various digital modulation techniques.	Understand	PO1
CO2	Learn about various digital carrier modulation techniques.	Understand	PO1
CO3	Apply various errors correction and detection codes to digital data.	Apply	PO1,PO2,PO4
CO4	Evaluate the error probability calculations for digital modulation techniques available	Analyze	PO1,PO2,PO4

Unit-I:

Pulse Digital Modulation:

Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error, Companding in PCM systems. Differential PCM systems (DPCM). Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems, noise in PCM and DM systems.

Outcome:

Understanding the basics of digital communication systems, and conversion of analog signal to digital signal

Activity/Event:

Observe the conversion of analog signal to digital signal using PCM modulation scheme.

Unit-II:

Gramschmitt Orthogonality Procedure, BandPass Modulation Techniques (Introduction, ASK, FSK, PSK, DPSK, QPSK, M-aryPSK, ASK, FSK, similarity of BFSK and BPSK.

Outcome: understanding the various carrier modulation techniques.
Activity/Event: Experimentally verify the FSK,PSK, modulation techniques.

Unit-III:

Data Transmission : Base band signal receiver, probability of error, the optimum filter, matched filter, probability of error using matched filter, coherent reception, non-coherent detection of FSK, calculation of error probability of ASK, BPSK, BFSK,QPSK.

Outcome:

Understanding the calculation of probability of error of different modulation schemes.

Activity/Event: Analyze the error probability comparison of different modulation schemes.

Unit-IV:

Information Theory: Discrete messages, concept of amount of information and its properties. Average information, Entropy and its properties. Information rate, Mutual information and its properties.

Source Coding: Introductions, Advantages, Shannon's theorem, Shanon-Fano coding, Huffman coding, efficiency calculations, channel capacity of discrete and analog Channels, capacity of a Gaussian channel, bandwidth –S/N trade off.

Outcome:

Understanding the measurement of information and its properties. and calculate the information rate using various source coding methods.

Activity/Event:

Analyze various source coding methods using Shannon fano and Huffman code.

Unit-V:

Linear Block Codes:

Introduction, Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes, Binary cyclic codes, Algebraic structure, encoding, syndrome calculation, BCH Codes.

Convolution Codes: Introduction, encoding of convolution codes, time domain approach, transform domain approach. Graphical approach: state, tree and trellis diagram decoding using Viterbi algorithm.

Outcome: understanding the error correction and detection using various methods.

Activity/Event: calculation of error correction and detection using linear block codes and convolution codes.

Text Books:

1. Digital communications - Simon Haykin, John Wiley, 2005
2. Principles of Communication Systems – H. Taub and D. Schilling, TMH, 2003

Reference Books:

1. Digital and Analog Communication Systems - Sam Shanmugam, John Wiley, 2005.
2. Modern Analog and Digital Communication – B.P.Lathi, Oxford reprint, 3rd edition

Course Code	COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	Credits
1004173103		3	1	0	3

Course Description:

This course gives a basic design of CPU and its control unit both hardwired and micro programmed control. It describes data transfer mechanisms between peripherals, memory and CPU.

Objectives:

- Understandthearchitectureofamoderncomputerwithitsvariousprocessingunits and the Performance measurement of the computer system.
- Construct the instruction format and control units including hardwired and micro programmed.
- Understand the I/O management and memory management system of computer.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Analyze the Performance of a computer using performance equation	Understand /Compare	PO1, PO2
CO2	Understand the different instruction types and calculate the effective address of an operand by addressing modes.	Understand/Choose	PO1, PO3, PO4, PO7, PO12
CO3	Understanding of how a computer performs micro arithmetic operation.	Understand/Design	PO1, PO3
CO4	Understand how the data transfer takes place using I/O mode, Interrupt, and DMA techniques with interfacing devices and data storage concepts.	Understand /Evaluate/ Choose	PO1, PO3, PO4, PO11 , PO12

UNIT – 1

Basic Structure Of Computers: Functional unit, Basic Operational concepts, Bus structures, System Software, Performance, Von Neumann Architecture, Harvard Architecture .

Outcome:

Explain the hardware and software components and its functions of a basic computer, factors affecting the Performance of computer.

Activity/Event:

Drawing of computer functional units and registers in CPU and their functions. Tabulate the Performance specifications for different types of computers.

UNIT-II

Machine Instruction and Programs:
Instruction and Instruction Sequencing: Register Transfer Notation, Assembly Language Notation, Basic Instruction Types, Basic Input/output Operations, The role of Stacks and Queues in computer programming equation. Component of Instructions: Logic Instructions, shift and Rotate Instructions. **ARM Processor:** Arithmetic and Logic Instructions, Branch Instructions, Addressing modes.

Outcome:

- Understanding of different instruction types.
- Calculate the effective address of an operand by different addressing modes.

Activity/Event:

Write Assembly Language Program for Arithmetic and Logical operations

UNIT-III

Processing Unit: Fundamental Concepts: Register Transfers, Performing an Arithmetic or Logic Operation, Fetching a Word from Memory, Execution of Complete Instruction, Hardwired Control,

Micro Programmed Control: Microinstructions, Micro program Sequencing, Wide Branch Addressing Microinstructions with next –Address Field

Outcome:

- Explain the execution of an instruction by a sequence of micro operations.
- Design Hardwired Control and Micro Programmed Control for a basic computer.

Activity/Event:

Draw a Hardwired Control and Micro Programmed Control for a basic computer.

UNIT-IV

Input/output Organization: Accessing I/O Devices, Interrupts: Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access, Buses: Synchronous Bus, Asynchronous Bus, Interface Circuits, Standard I/O Interface: Peripheral Component Interconnect (PCI) Bus, Universal Serial Bus (USB).

Outcome:

They explain how the data transfer takes place using I/O mode, Interrupt, and DMA techniques with interfacing devices.

Activity/Event:

- Draw diagrams for different types of data transfer techniques.
- Explain the peripheral interconnection busses.

UNIT-V

The Memory Systems: Basic memory circuits, Memory System Consideration, Read-Only Memory: ROM, PROM, EPROM, EEPROM, Flash Memory,

Cache Memories: Mapping Functions, Interleaving

Secondary Storage: Magnetic Hard Disks, Optical Disks.

Outcome:

Explain different types of storage mechanisms with their interfacing to system bus.

Activity/Event:

- Draw circuit diagrams for different types of semi conductor memories.
- Explain the cache memory and mapping methods with main memories.

TEXT BOOKS:

1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, McGrawHill, 5th Edition, 2011.

REFERENCE BOOKS

1. Computer Architecture and Organization, John P. Hayes, McGrawHill, 3rd Edition, reprint 2007.
2. Computer Organization and Architecture, William Stallings,Pearson/PHI, 6th Edition, reprint 2010.

Course Code		L	T	P	Credits
1004173104	**DIGITAL IC APPLICATIONS**	3	1	0	3

Course Overview:

In this course it is aimed to introduce to the students, the electrical behaviour of CMOS both in static and dynamic conditions and before that study the diode/transistor-transistor logic and Emitter coupled logic. In this course, students can study Integrated circuits for all digital operational designs like adder, subtractor, multipliers, multiplexers, registers, counters, flip flops, encoders, decoders and memory elements like RAM and ROM. Design and to develop the internal circuits for different digital operations and simulate them using hardware description language. Understand the concepts of SSI Latches and Flip-Flops and Design of Counters using Digital ICs, modelling of sequential logic integrated circuits using VHDL

Course Objectives:

- Introduction to different digital logic families, applications and interfacing concepts for digital design
- VHDL fundamentals were discussed in modeling digital system design blocks.
- VHDL compilers, simulators and synthesis tools are described, which are used to verify digital systems in a technology-independent fashion.
  Design and implementation of combinational and sequential digital logic circuits is explained

Course Outcomes:

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Understand the structure of commercially available digital integrated circuit families	Understanding	PO1,PO2
CO2	Learn the IEEE Standard 1076 Hardware Description Language (VHDL)	Understanding	PO3,PO5
CO3	Model complex digital systems at several levels of abstractions, behavioural, structural, simulation, synthesis and rapid system prototyping	Applying	PO4,PO5
CO4	Analyze and design basic digital circuits with combinatorial and sequential logic circuits using VHDL	Analysing	PO3,PO5

Unit-I:

Digital Logic Families and Interfacing: Introduction to logic families, CMOS logic, CMOS steady state and dynamic electrical behaviour, CMOS logic families. Bipolar logic, transistor-transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emitter coupled logic.

Outcome: Understand the structure of commercially available digital integrated circuit families

Activity/Event: study the electrical behaviour of logic families and interfacing

Unit-II:

Digital Design Using HDL: Design flow, program structure, History of VHDL, VHDL requirements, Levels of Abstraction, Elements of VHDL, Concurrent and Sequential Statements, Packages, Libraries and Bindings, Subprograms, Comparison of VHDL and Verilog HDL

Outcome: Learn the IEEE Standard VHDL, Model complex digital systems at several levels of abstractions, behavioural, structural, dataflow

Activity/Event: study the VHDL language

Unit-III:

VHDL Modelling : Simulation, Logic Synthesis, Inside a logic Synthesizer, Functional Gate-Level verification, Place and Route, Post Layout Timing Simulation, Static Timing, Major Net list formats for design representation

Memories

ROM: Internal structure, 2D-Decoding, Commercial ROM types, timing and applications,.
Static RAM: Internal structure, SRAM timing, standard, synchronous SRAMS
Dynamic RAM: Internal structure, timing, synchronous DRAMs

Outcome: Understand the simulation, synthesis and different memories in digital ICs

Activity/Event: study the simulation, synthesis and different memories

Unit-IV:

Combinational Logic Design: Adders & Subtractors, Ripple Adder, Look Ahead Carry Generator, Binary Parallel Adder, Binary Adder-Subtractor, ALU, Decoders, encoders, three state devices, multiplexers and demultiplexers, Code Converters, parity circuits, comparators, multipliers, Barrel Shifter, Simple Floating-Point Encoder, Cascading Comparators, Dual Priority Encoder, Design considerations with relevant Digital ICs, modeling of Circuits by using VHDL.

Outcome: Analyze and design basic digital circuits with combinational logic circuits using VHDL

Activity/Event: Design combinatorial logic circuits using VHDL

Unit-V:

Sequential Logic Design: SSI Latches and Flip-Flops, Counters, Design of Counters using Digital ICs, Ring Counter, Johnson Counter, Modulus N Synchronous Counters, MSI Registers, Shift Registers, Modes of Operation of Shift Registers, Universal Shift Registers, MSI Shift Registers, Design considerations with relevant Digital ICs, modelling of circuits by using VHDL.

Outcome: Analyze and design basic digital circuits with sequential logic circuits using VHDL

Activity/Event: Design sequential logic circuits using VHDL

Text Books:

1. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Edition, 2005.
2. VHDL Primer, J. Bhasker, Pearson Education/ PHI, 3rd Edition, 1995.

Reference Books:

1. Fundamentals of Digital Logic with VHDL Design- Stephen Brown, Zvonko Vranesic, Mc Graw Hill, 3rd Edition, reprint 2004.

Course Code		L	T	P	Credits
1004173105	**ANTENNAS AND WAVE PROPAGATION**	3	1	0	3

Course Overview:

This course's objective is to introduce the student to antennas, covering their principles of radiation, their basic parameters, (radiation resistance, radiation pattern, polarization, reciprocity, effective radiated power), their general types, and those commonly used in wireless systems. The student also learns the various propagation mechanisms/impairments and the basic models of propagation. Atmospheric and weather effects are also reviewed. The student would be able to apply this to determine the range of a wireless RF/microwave system, using what the student know about propagation mechanisms/impairments and the basic models of propagation to determine approximately the range of point-to-point system. The student also learns the various techniques of diversity and combining methods to improve the system performance

Course Objectives:

- To learn the basic working of antennas
- To study various antennas, arrays and radiation patterns of antennas.
- To understand various techniques involved in various antenna parameter measurements
- To understand the propagation of radio waves in the atmosphere

Course outcome:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Explain the process of radiation from an open ended transmission line	Understand	PO1, PO2, PO3
CO2	Explain the behaviour of an antenna in terms its parameters and Compute the fields and radiation resistance of a family of antenna.	Apply	PO1, PO2, PO3, PO5, PO9, PO12
CO3	Select appropriate antenna for a given applications (TV, radar, wireless)	Apply	PO1, PO2, PO3 PO5, PO9, PO12
CO4	Design dipole, Yagi and patch antenna for a given specification	Create	PO1, PO2, PO3 PO5, PO9, PO12

Unit-I :

Antenna Fundamentals & Linear Wire Antennas:

Introduction, Radiation Mechanism: single wire, two wire, dipoles, Current Distribution on a thin wire antenna.

Antenna Parameters: Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam width, Beam Area, Bandwidth, input impedance, Radiation Intensity, Beam Efficiency, Directivity, Gain, Antenna Apertures, Antenna efficiency, Effective Height, Antenna regions, Friis Transmission equation

Retarded Potentials. Radiation from Small Electric Dipole, Quarter wave Monopole, Half wave Dipole,

Half wave dipole: Evaluation of Field Components, Power Radiated, and Radiation Resistance, Applications of half wave dipole.

Outcome: Student will understand all antenna parameters and analyze wire antennas

Activity/Event :

Design and analyze the dipole antenna characteristics using Matlab For different lengths

Unit-II :

Antenna Arrays

2 Element Arrays: Different cases, Principle of Pattern Multiplication.

N Element Uniform Linear Arrays: Broadside, End fire Arrays, Concept of Scanning Arrays. Effects of Uniform and Non-uniform Amplitude Distributions, Binomial Arryas, Related Problems.

Methods of Array synthesis: Tchebyscheff Distribution and Fourier Transform Method

Arrays with Parasitic Elements: Yagi - Uda Arrays, Folded Dipoles & their characteristics.

Outcome: Learn about Arrays, application of wire antennas

Activity/Event: Uniform Array design, Yagi - Uda Arrays by using CST software

Unit-III:

HF, VHF, UHF :

Traveling wave radiators – basic concepts, Long wire antennas – field strength calculations and patterns, V-antennas, Rhombic Antennas and Design Relations

Small Loop antennas- Small Loops - Field Components, Comparison of far fields of small loop and short dipole

Helical Antennas:

Significance, Geometry, basic properties, Design considerations for monofilar helical antennas in Axial Mode and Normal Modes (Qualitative Treatment).

Outcome: Understand about HF,VHF antennas

Activity/Event: Design of Rhombic antenna by using matlab

Unit-IV :

Microwave Antennas

Paraboloidal Reflectors: Geometry, characteristics, types of feeds, F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Off-set Feeds and Cassegrain Feeds.

Microstrip antennas, Horn antennas, Lens antennas (Qualitative treatment only)

Antenna Measurement Theory: Antenna Measurements-Patterns Required, Set Up, Distance Criterion, Directivity and Gain Measurements (Comparison, Absolute and 3Antenna Methods).

Outcome: Analyze antenna measurements to assess antenna's performance

Activity/Event: Design of Microstrip Antenna using CST

Unit-V :

Wave Propagation

Concepts of Propagation: Frequency ranges and types of propagations

Ground Wave Propagation Characteristics, Parameters, Wave Tilt, **Sky Wave Propagation**: Formation of Ionosphere Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF & Skip Distance, Optimum working Frequency, Virtual Height. Ionospheric Abnormalities, Ionospheric Absorption

Space Wave Propagation: Mechanism, LOS and Radio Horizon.

Tropospheric Wave Propagation–Radius of Curvature of path, Field Strength Calculations, Related problems. Skip distance calculations for spherical earth case, M-curves and Duct Propagation

Outcome: Identify the characteristics of radio wave propagation

Activity/Event: Calculating MUF & Skip Distance calculations for flat earth case, Optimum working Frequency, Virtual Height for skywave region

Text Books:

1. Antennas for All Applications – John D. Kraus and Ronald J. Marhefka, 3rd Edition, TMH, 2003.
2. Antenna Theory - C.A. Balanis, John Wiley and Sons, 2nd Edition, 2001

Reference Books:

1. G.S.N Raju, "Antennas and Wave Propagation", 1st Edition Pearson Education, 2004.
2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, 3rd Edition, New Delhi, 2001.
3. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.
4. Electronic and Radio Engineering – F.E. Terman, McGraw-Hill, 4th Edition, 1955.

Course Code		L	T	P	Credits
1004173121	**INTEGRATED CIRCUITS/PULSE AND DIGITAL CIRCUITS LAB**	0	0	3	2

List of Experiments (Ten experiments to be done):

The students have to calculate the relevant parameters

1. Non linear wave shaping
   (a) Clippers (b) Clampers
2. Op amp applications –Adder, Subtractor, Comparator.
3. Linear wave shaping
   (a) Low pass filter using passive elements.
   (b) High pass filter using passive elements.
4. Active Filters
   (a) Low pass filter using Op-amp
   (b) High pass filter using Op-amp
5. Function generator using Op-amp
   (a) Sine wave generator
   (b) Square wave generator
6. Astable multivibrator using transistors
7. Astable multivibrator using Timer 555 IC
8. Monostable multivibrator using transistors.
9. Monostable multivibrator using Timer 555 IC.
10. Schmitt trigger using transistor.
11. Schmitt trigger using
    (a) Op amp
    (b) Timer 555
12. Voltage Regulator
    (a) Fixed
    (b) Variable

Equipment:

1. RPS - 0 – 30 V
2. CRO - 0 – 20 M Hz.
3. FunctionGenerators - 0 – 1 MHz
4. Components
5. Multimeters
6. SpectrumAnalyser

Course Code		L	T	P	Credits
1004173122	**DIGITAL COMMUNICATIONS LAB**	0	0	3	2

List of Experiments (Twelve experiments to be done) :

The students have to calculate the relevant parameters

(a. Hardware, b. MATLAB Communication tool box)

1. Time division multiplexing.
2. Pulse code modulation.
3. Differential pulse code modulation.
4. Delta modulation.
5. Frequency shift keying.
6. Phase shift keying .
7. Differential phase shift keying.
8. Companding
9. Source Encoder and Decoder
10. Linear Block Code-Encoder and Decoder
11. Binary Cyclic Code – Encoder and Decoder
12. Convolution Code – Encoder and Decoder

Equipments & Software required:
Software :

1. Computer Systems with latest specifications.
2. Connected in Lan (Optional).
3. Operating system (Windows XP).
4. Simulations software (Simulink & MATLAB)
5. RPS - 0 – 30 V
6. CRO - 0 – 20 M Hz.
7. Function Generators - 0 – 1 MHz
8. Components
9. Multimeters
10. Spectrum Analyzer

Course Code	DIGITAL IC APPLICATIONS LAB	L	T	P	Credits
1004173123		0	0	3	2

The students are required to design and draw the internal structure of the following Digital Integrated Circuits and to develop VHDL source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary synthesizer. Further, it is required to verify the logic with necessary hardware.

List of Experiments:

1. Realization of Logic Gates
2. Design of Full Adder using 3 modeling systems
3. Design 4 bit parallel adder using full adder
4. 3 to 8 Decoder- 74138
5. 8 to 3 Encoder (with and without priority)
6. 8*1 Multiplexer-74151 and 2*1 De-multiplexer-74155
7. 4-Bit Comparator-7485
8. ALU
9. D Flip-Flop- 7474
10. Decade Counter- 7490
11. 4 Bit Counter-7493
12. Shift Register-7495
13. Universal shift register-74194/195
14. 8-bit serial in-parallel out and parallel in-serial out shift register

Equipment Required:

1. Xilinix ISE software-latest version
2. Personal computer with necessary peripherals
3. Hardware kits- Various FPGA families.

Course Code	PROFESSIONAL ETHICS & HUMAN VALUES	L	T	P	Credits
1099172103		3	0	0	0

Course Overview:

Professional Ethics and Human Values subject provides character-oriented education that instils basic values and ethnic value in one's individual professionalism.

Course Objectives:

1. To encourages students to discover what they consider valuable.
2. To move from discrimination to commitment. It is to create an ability to act on any discrimination in a given situation.
3. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
4. To appreciate the rights of others.
5. Making the students aware and sensitive to value system in real life situations. To help the students to discriminate between ephemeral and eternal values.

Course Outcomes:

	Course Outcome	Cognitive level as per Bloom's Taxonomy	PO
CO1	Recognize importance of human values, harmony and ethical behavior in real life situations	Understanding	8
CO2	Describe the core values that shape the ethical behaviour of an engineer	Understanding	8
CO3	Recall basics of professional ethics and human values.	Remembering	8
CO4	Listing sustained happiness through identifying the essentials of human values and skills.	Remembering	8
CO5	Describe the practical importance of trust, mutually satisfying human behaviour and enriching interaction with nature	Understanding	8

Unit-I:

Human Values :

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully -Caring – Sharing – Honesty –Courage – Value time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality-Character

Outcome:

- To understand different types of human values.
- To Identify values linked to the ethical behavior

Activity/Event: Seminar

Unit-II:

Engineering Ethics:

The History of Ethics-Purposes for Engineering Ethics-Engineering Ethics-Consensus and Controversy – Professional and Professionalism –Professional Roles to be played by an Engineer –Self Interest, Customs and Religion-Uses of Ethical Theories-Professional Ethics-Types of Inquiry – Engineering and Ethics- Kohlberg's Theory – Gilligan's Argument – Heinz's Dilemma

Outcome:

- To enable understanding on engineering ethics
- To enable knowledge on professional level ethical theories

Activity/Event: Seminar

Unit-III:

Engineering as Social Experimentation:

Comparison with Standard Experiments – Knowledge gained –Conscientiousness – Relevant Information – Learning from the Past – Engineers as Managers, Consultants, and Leaders – Accountability – Role of Codes – Codes and Experimental Nature of Engineering.

Outcome: Seminar

- To Understand the application of ethics in social experimentation
- To gain knowledge on a engineers as different roles

Activity/Event: Case Analysis

Unit-IV:

Engineers' Responsibility for Safety and Risk:

Safety and Risk, Concept of Safety – Types of Risks – Voluntary v/s Involuntary Risk- Short term v/s Long term Consequences- Expected Probability- Reversible Effects- Threshold Levels for Risk- Delayed v/s Immediate Risk- Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

Outcome: Seminar

- To understand the challenge for engineers to create safety to risk
- To enable the knowledge on the risk bearable level

Activity/Event: Seminar

Unit-V:

Engineers' Responsibilities and Rights:
Collegiality-Loyalty-Professionalism and Loyalty- Professional Rights –Professional Responsibilities – confidential and proprietary information-Conflict of Interest-Ethical egoism-Collective bargaining-Confidentiality-Acceptance of Bribes/Gifts- when is a Gift and a Bribe-examples of Gifts v/s Bribes-problem solving-interests in other companies-Occupational Crimes-industrial espionage-price fixing-endangering lives- Whistle Blowing-types of whistle blowing-when should it be attempted-preventing whistle blowing. Cross-culture Issues.

Outcome: Seminar

- To enable understanding on engineers responsibilities
- To enable knowledge on different types of rights of engineers

Activity/Event: Seminar

Text Books:

1. "Engineering Ethics and Human Values" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar- PHI Learning Pvt. Ltd-2009
2. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications
3. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications
4. "Professional Ethics and Human Values" by Prof.D.R.Kiran

Reference Books:

1. "Indian Culture, Values and Professional Ethics" by PSR Murthy-BSP Publication
2. "EthicsinEngineering"byMikeW.MartinandRolandSchinzinger–TataMcGraw-Hill–2003.
3. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

DETIALED SYLLABUS

FOR

III-B.Tech

II SEMESTERS

Course Code		L	T	P	Credits
1004173201	**MICROPROCESSORS AND MICROCONTROLLERS**	3	1	0	3

Course Overview:

This Course brings out the basic hardware design concept of Intel 16 bit microprocessor 8086 and Intel 8 bit 8051 Microcontroller and 32 bit ARM processor. It introduces the assembly language programming with 8086 and 8051 processors and programming is practiced simultaneously in MPMC Lab course. I/O and memory interfacing is studied both with 8086 and 8051 Microcontrollers. Finally students are introduced to use the usage of these chips for industrial automation.

Course Objectives:

- To understand the architecture, addressing modes, Instruction set of Intel 8086 Microprocessor and Intel 8051and ARM Processor.
- To apply the instruction set in solving simple problems and create small assembly language programs.
- Understand the hardware concepts of basic peripheral Chips and evaluate the interfacing requirements of the basic peripheral chips.

Course Outcomes:

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Understand the concepts of architecture, memory organization of Intel 8086 microprocessor and ARM and Intel 8051 microcontrollers.	Understand	PO1
CO2	Understand the concepts of addressing modes, instruction set of Intel 8086 microprocessor and Intel 8051 and ARM processor	Understand	PO2
CO3	Write assembly language programs for simple problem statements	Apply, Analyze	PO2, PO4, PO5
CO4	Design an interface between peripheral chips & processors and write programs for data transfer	Analyze	PO2, PO4, PO5

Unit-I:

8086 ARCHITECTURE: Main features, pin diagram/description, 8086 microprocessor family, 8086 internal architecture, bus interfacing unit, execution unit, 8086 system timing, minimum mode and maximum mode configuration.

Outcome:

Student understand the internal block diagram of 16 bit 8086 chip and it's functions. Further student is introduced to the concept of interconnecting the 8086 microprocessor with memory and peripheral chips to make a system. Student Understands the timing and sequence of control signals between processor and other memory and peripheral chips for data transfer between them.

Activity/Event:

Draw diagrams for the internal architecture, pin diagram and signal description, minimum mode system and maximum mode system, Timing diagram for bus signals during read and write operation.

Unit-II:

8086 PROGRAMMING: Program development steps, addressing modes, instructions, assembler directives, interrupts and interrupt responses, writing simple programs with an assembler

Outcome:

Student understands the operations of instruction set and the operand addressing modes. Able to explain the concept of interrupt and processor response for the interrupt. Able to explain how to use interrupt mechanisms to execute some functions. Understand the facilities available for program development and able to make assembly language programs.

Activity/Event:

Write assembly language programs with procedures and interrupt procedures for solving a given problem following program development steps.

Unit-III:

8086 INTERFACING: Semiconductor memories interfacing(RAM,ROM), Intel 8259 programmable interrupt controller, software and hardware interrupt applications, Intel 8257 DMA controller, Intel 8255 programmable peripheral interface, Intel 8279 programmable keyboard/display controller, 8251 USART interfacing.

Outcome:

Student explains the techniques for interfacing semiconductor memories(RAM and ROM) with system bus. Understand the functions of internal blocks and registers available in peripheral chips like 8259, 8255, 8257 and 8251 chips and the interfacing of these chips to system bus.

Activity/Event:
Draw interface circuits of the peripheral chips 8259,8255,8257 and 8251 to system bus and peripheral devices to effect data transfer; draw the control words and internal architecture of above peripheral devices.

Unit-IV:

8051 MICROCONTROLLER: Architecture, hardware concepts, input/output ports and circuits, external memory, counters/timers, serial data input/output, interrupts.
Assembly language programming: Instructions, addressing modes, simple Programs.
Interfacing: keyboard, displays (LED, 7-segment display unit), A/D and D/A converters. Stepper motor interfacing.

Outcome:
Understand the internal architectural blocks and their functions including timer/counter operation and serial port operation. Understand the data addressing modes available, operation of instructions and write assembly language programs for simple programs. Able to interface keyboards, display devices like LED, 7-segment display, LCD, stepper motor and A/D and D/A converters.

Activity/Event:
Draw architectural diagram and pin diagram of 8051.Write programs for simple mathematical operations, Draw an interfacing circuit and write program for data transfer between keyboard, display devices, stepper motors , ADC and DAC devices.

Unit-V:
ARM7 Processor: Fundamentals, Registers, Pipeline, addressing modes, Instruction set, simple programs, difference between CISC & RISC.

Outcome: Understand the difference between CISC and RISC processors.

Activity/Event: execution of simple programs on keil software

Text Books:

1. Microprocessors and Interfacing–Programming and Hardware,DouglasV Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition.
2. ARM system Developer's guide designing & optimizing system software, Andrew N.Sloss, Dominic Symes, Chris Wright, Elsevier, 2004

Reference Books:

1. The 8051 Microcontroller, KennethJ.Ayala, Thomson, 1st edition, reprint 2007.
2. Microprocessors and Microcontrollers,N. Senthil Kumar, M.Saravanan and S. Jeevananthan, Oxford University Press, 7thImpression, 2013.

Course Code 1004173202	COMMUNICATION NETWORKS	L 3	T 1	P 0	Credits 3

Course Description and Objectives:

This course will use a Top-Down approach to study the Internet and its protocol stack- Architecture, protocol, application-examples will include E-mail, web and media streaming

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Understand ISO-OSI and TCP/IP models and various Network topology models	Understand	PO1
CO2	Analyze MAC layer protocols and LAN technologies	Analyse	PO1, PO2, PO12
CO3	Understand routing and congestion control algorithms	Understand	PO1
CO4	Apply the knowledge of Internet protocols to design the applications and Understand how Internet works	Apply, Creating	PO1, PO2, PO3, PO4, PO12

UNIT – I

INTRODUCTION: Reference models-ISO-OSI and TCP/IP models, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies, WAN, LAN, MAN.

Outcome:

- Basic understanding of network designing
- Able to differentiate between ISO-OSI and TCP/IP models

Activity/Event: Discussion is going to be conducted among the students regarding

- ISO-OSI Vs TCP-IP
- Network Topologies

UNIT-II

PHYSICAL LAYER: Guided Transmission media- Copper, Twisted pair, Optical fiber and Unguided Transmission media, Switching- circuit, packet and message switching, Encoding,

Multiplexing-FDM, TDM and CDM Narrow band and Broad band ISDN and ATM- AAL Layer Protocol

Outcome:

- Knowledge of Various Transmission media available
- Various types of Multiplexing strategies and Line coding techniques

Activity/Event:

Discussion is going to be conducted among the students regarding Transmission media strategies, ISDN techniques and Multiplexing methods

UNIT-III

DATA LINK LAYER: Design issues, Framing, Error detection and correction, CRC, Elementary Protocol-stop and wait, Sliding Window Protocols.

Medium Access Sub Layer: channel allocation, Multiple access protocols-ALOHA, Carrier sense multiple access, MAC addresses, IEEE 802.X Standard Ethernet, Fast Ethernet and Gigabit Ethernet, Wireless LANS.

Outcome:

- Design considerations in Data Link Layer
- Multiple access schemes and ETHERNET techniques

Activity/Event: Discussion is going to be conducted among the students regarding data link layer design issues

UNIT-IV

NETWORK LAYER: Design issues of Network layer, Routing algorithms- shortest path routing, Flooding, Hierarchical routing, Broad cast, Multi cast, Distance vector routing. Rotary for mobility.

Congestion Control Algorithms – General Principles of Congestion prevention policies.
Internetworking: The Network layer in the internet (IPv4).

Outcome:

- Routing algorithms available and their significance
- Internet protocol architecture

Activity/Event:

Able to identify which strategy of routing algorithm is adopted according to different metrics

UNIT-V

TRANSPORT LAYER: Transport Services, Connection management, Internet Transport Protocols-TCP and UDP

APPLICATION LAYER: Domain Name System-DNS name space, Resource records and name servers, Electronic Mail-Architecture and services, User agent, message formats, message transfer and final delivery.

Outcome:

- Basic Idea of Transport protocols
- Idea of how internet applications work

Activity/Event: Able to identify which strategy of transport protocol is adopted according to different strategies

Text Books:

1. Computer Networks, Andrew S Tanenbaum, Pearson Education/PHI, 4th Edition, reprint 2003.
2. Data Communications and Networking, Behrouz A. Forouzan. TMH, 4th Edition, reprint 2016.

Reference Books:

1. Computer Networks A top down approach, Behrouz A.Forouzan, FirouzMosharraf, McGraw Hill Education, 1st edition, reprint 2012.
2. An Engineering Approach to Computer Networks, S.Keshav, Pearson Education, 2nd Edition, reprint 2008.

Course Code	VLSI DESIGN	L	T	P	Credits
1004173203		3	1	0	3

Course Description:

Design the stick and layout diagrams for NMOS, PMOS & CMOS technologies.

Course Objectives:

The student will be able to

- Use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnections.
- Learn the various fabrication steps of IC and come across basic electrical properties of MOSFET.
- Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect and to verify the functionality, timing, power and parasitic effects.
- The concepts and techniques of modern integrated circuit design and testing (CMOS VLSI).
- Design static CMOS combinational and sequential logic at the transistor level, including mask layout.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Describe the fabrication process for MOS,CMOS and BICMOS technologies along with their electrical properties	Understanding	PO1,PO2
CO2	Outline the concepts of design rules during the layout design	Understanding	PO2,PO3,PO5
CO3	Model various scaling Models and factors and their effects on MOSFET parameters.	Apply	PO3,PO4
CO4	Examine various design issues of VLSI Circuits and illustrate FPGA Design	Analyze	PO3,PO4

UNIT – I

Introduction: Introduction to IC Technology, MOS and related VLSI Technology, IC production process, MOS and CMOS Fabrication processes, BiCMOS Technology, Comparison between CMOS and Bipolar technologies.

Basic Electrical Properties of MOS and Bi-CMOS Circuits: Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans conductance, Output Conductance and Figure of Merit. The Pass transistor, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter. Alternative forms of pull-up, The CMOS Inverter, MOS transistor circuit model, Bi-CMOS Inverter, Latch-up in CMOS circuits and BiCMOS Latch-up Susceptibility

Outcome: Understand the concepts of MOS, CMOS&BICMOS technologies for the layout design.

Activity/Event: Derive the expressions for V-I for EMOSFET & DMOSFET.

UNIT-II

MOS and Bi-CMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2μm Double Metal, Double Poly, CMOS/BiCMOS rules, 1.2μmDouble Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter.

Outcome: Apply the concepts of design rules during the layout design.

Activity/Event: Design the stick and layout diagrams of basic, universal, AOPI,OAI& special gates.

UNIT-III

Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Choice of layers, Transistor switches, Realization of gates using NMOS, PMOS and CMOS technologies.

Scaling of MOS Circuits: Scaling models, Scaling factors for device Parameters, Limits due to sub threshold currents, current density limits on logic levels and supply voltage due to noise.

Outcome: How MODFET parameters affects the scaling of MOS circuits.

Activity/Event: Determine the sheet resistance, standard unit of capacitance and delays for different technologies.

UNIT-IV

Subsystem Design: Architectural issues, switch logic, Gate logic, examples of structured design, clocked sequential circuits, system considerations, general considerations of subsystem design processes, an illustration of design processes.

Outcome: Model & simulate digital VLSI systems using HDL and synthesize digital VLSI systems from RTL.

Activity/Event: Design the switch logic and gate logic circuits.

UNIT-V

VLSI Design Issues: VLSI Design issues and design trends, design process, design for testability, technology options, power calculations, package selection, clock mechanisms, mixed signal design, ASIC design flow, FPGA design flow, introduction to SoC design.

FPGA Design: Basic FPGA architecture, FPGA configuration, configuration modes, FPGA families, FPGA design examples-stack, queue and shift register implementation using VHDL.

Outcome: Understand the current trends in semiconductor technology & how it impacts scaling & performance.

Activity/Event: Execute different VHDL programs using front end design process.

Text Books:

1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, Douglas and A. Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited, 1st Edition, 2009.
2. VLSI Design Black Book, Dr. K.V.K.K. Prasad, Kattul Shyamala, Kogent Learning Solutions Inc. 1st Edition, 2012

Reference Books:

1. VLSI Design, A.Albert Raj &T.Latha,PHI Learning Private Limited,1st edition,2010.
2. VLSI Design, A.Shanthi and A.Kavita, New Age International Private Limited, 1st Edition 2006.

Course Code		L	T	P	Credits
1004173204	**DIGITAL SIGNAL PROCESSING**	3	1	0	3

Course Overview:

Signal processing is one of the fundamental theories and techniques to construct modern information systems. Signal processing is concerned with the representation, transformation, and manipulation of signals and the information they contain.

Course Objectives:

The student will be able to

- Define and use Discrete Fourier Transforms (DFTs)
- Use Z - transforms and discrete time Fourier transforms to analyze a digital system.
- Understand simple finite impulse response filters
- Learn the design procedures used for filter bank
- Learn to program a DSP processor to filter signals

Course Outcomes:

After completion of the course students able to learn :

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Design, simulate and realize different digital filters.	Apply, Analyze	PO1,PO2,PO3, PO4, PO5
CO2	Estimate the spectra of signals that are to be processed by discrete time system and to verify the performance of various spectrum estimation techniques	Understand , Apply	PO1,PO2, PO5
CO3	Design multi rate digital signal processing system.	Apply	PO1,PO2,PO3, PO4, PO5
CO4	Understand the architecture of DSP processor	Understand	PO1

Unit-I:

Introduction:

Introduction to Digital Signal Processing: Discrete time signals & sequences, linear shift invariant systems, stability, and causality. Linear constant coefficient difference equations, solution of difference equations. Frequency domain representation of discrete time signals and systems.

Outcome: Able to analyze different systems.

Activity/Event: By solving the different example problems.

Unit-II:

Discrete Fourier Series & Fourier Transforms:

Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear convolution of sequences using DFT, Computation of DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

Outcome: To get the complete knowledge on Fourier Transform

Activity/Event: Discussion on the topic among the students.

Unit-III:

IIR & FIR Digital Filters:

Basic structures of IIR and FIR systems, Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples: Analog-Digital transformations Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques, Frequency Sampling technique, Comparison of IIR & FIR filters.

Outcome: Able to design the filters.

Activity/Event: problem solving using matlab software.

Unit-IV:

Multirate Digital Signal Processing:

Decimation, interpolation, fractional sampling rate conversion and its Implementation, efficient transversal structure for interpolator and decimator, applications of multi rate DSP.

Outcome: Able to know about the concept of sampling.

Activity/Event: by solving different examples.

Unit-V:

Introduction To DSP Processors:
Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs Multiple access memory ,multiport memory, VLSI architecture, Pipelining, Special addressing modes, On-Chip Peripherals. Architecture of TMS 320C5XIntroduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, Some flags in the status registers, On- chip registers, On-chip peripherals.

Outcome: Able to know about the concept of DSP processors.

Activity/Event: By conducting seminars.

Text Books:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris Z.Manolakis, Pearson Education / PHI, 4th edition, 2007.
2. Digital Signal Processors Architecture, Programming and Applications, B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 1st edition, 2002.

Reference Books:

1. Digital Signal Processing, A. Anand Kumar, PHI, 2nd edition, reprint 2014.
2. Digital Signal Processing, P.Ramesh babu, Scitech 4th edition, reprint 2007.

Course Code	INTRODUCTION TO DATA BASE MANAGEMENT SYSTEMS (Open Elective I)	L	T	P	Credits
1005173206		3	1	0	3

Course Overview:

This course introduces database design and creation using a DBMS product. Emphasis is on data dictionaries, normalization, data integrity, data modelling, and creation of simple tables, queries, reports, and forms. Upon completion, students should be able to design and implement normalized database structures by creating simple database tables, queries, reports, and forms.

Course Objectives:

- Provide students with theoretical knowledge and practical skills in the use of database and database management systems in information technology applications.
- The logical design, physical design and implementation of relational databases are covered.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Describe ER model and normalization f or database design.	Analyzing	PO1, PO2, PO4
CO2	Create, maintain and manipulate a relational database using SQL	Applying	PO1,PO2,PO4,PO5
CO3	Design and build database system for a given real world problem	Applying	PO1,PO2,PO4,PO5
CO4	Examine issues in data storage and query processing and can formulate appropriate solutions.	Understand	PO1, PO2

Unit-I:
Introduction to Database Systems:

File System Vs DBMS, Advantages of DBMS, Structure of DBMS, Levels of Data Abstraction (Data Independence), Database Users and Administrators, Different Data Models.

E-R Model: Overview of Database Design, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model
Outcome: After Completion of the Unit, Student will Be able to:

1. Describe the Architecture of Database Management Systems
2. Design different ER Models
3. Understand the applications of dbms, difference between file systems vs dbms, identify the data models ,understand dbms structure

Activity: Draw ER Diagram for Various Real Time Systems.

Unit-II:

Relational model: Introduction to the Relational Model, Relational model constraints over relations. Relational Algebra and calculus

Outcome:

After Completion of the Unit, Student will Be able to:

1. To differentiate the knowledge in TRC & DRC
2. Compare relational model with the structured query language (SQL)
3. Understands the relational algebra concepts, selection ,projection ,relational calculus which helps in understanding queries

Activity: Tabulate Various Relational Models for Real Time Application.

Unit-III:

SQL Queries: The Form of Basic SQL Query, Union, Intersect and Except-Nested Queries-Aggregative Operators- Group By and Having Clauses-Null Values-Outer Joins, triggers

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF)

Outcome: After Completion of the Unit, Student will Be able to:

1. Design the new database.
2. Master the basic concepts and appreciate the applications of database systems.
3. Master the basics of SQL and construct queries using SQL.

Activity: Design a new Database and normalize the data
Unit-IV:

Overview of Storage and Indexing:

Data on External Storage – File Organization and Indexing– Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing.

Outcome: After Completion of the Unit, Student will Be able to:

1. Differentiate different indexing techniques in real time.
2. An ability to use and apply current technical concepts and practices in the coreinformation technologies.
3. Be familiar with a commercial relational database system (Oracle) by writing SQLusing the system.

Be familiar with the relational database theory, and be able to Write relational algebra expressions for queries

Outcome: After Completion of the Unit, Student will Be able to:

4. Differentiate different indexing techniques in real time.
5. An ability to use and apply current technical concepts and practices in the core information technologies.
6. Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.
7. Be familiar with the relational database theory, and be able to Write relational algebra expressions for queries

Activity: Create your own data base and connect the front-End and back-End.

Unit-V:

Introduction to transaction management, ACID properties, transaction states, concurrent and non concurrent schedules, requirement of concurrency control, requirement of recovery, log based recovery.

Outcome: After Completion of the Unit, Student will Be able to:

1. Understands the properties of transaction management.

Activity: Perform Transaction on Various Real Time Concepts.

Text Books:

1. Database Management Systems, 3/e Raghuram Krishnan, Johannes Gehrke, TMH
2. Database System Concepts. 6/e Silberschatz, Korth, TMH
3. Database Management System, 6/e RamezElmasri, Shamkant B. Navathe, PEA

Reference Books:

1. Introduction to Database Systems, 8/e C J Date, PEA
2. The Database book principles & practice using Oracle/MySqlNarainGehani, University Press.
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Course Code	INTRODUCTION TO PYTHON PROGRAMMING (Open Elective I)	L	T	P	Credits
1005173207		3	1	0	3

Course Overview:

This course introduces computer programming using the Python programming language which will help you to master the Programming with Python by introducing the Object Oriented programming concepts, creation of Data Structures, Implementation of Functions, and Visualization libraries. Lastly you will get into design, code, test, and debug Python programming Language Scripts.

Course Objectives:

- Introduction to Scripting Language.
- Exposure to introduce Data Structures concepts using Python.
- Emphasis to Object Oriented programming concepts.
- Gain knowledge of Python visualization libraries.
- Exposure to various problems solving approaches of computer science and information Technology.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Install Python IDE and run basic Python scripts.	Understand	PO1
CO2	Understand the operators, functions, key Concepts of Object Oriented Programming in python.	Understand	PO1, PO2
CO3	Access Python from various online resources and import packages to the current working environment.	Applying	PO5
CO4	Develop front end GUI using Visualization Libraries and Multithreading techniques.	Analyzing	PO12

UNIT-I

Introduction:
History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

Types, Operators and Expressions: Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations

Outcome:

1. Understand the Introduction of Python IDE.
2. Learn the basics building blocks of python.
3. Write the basic programs in python.
4. Learn the different types of operators in python

Activity:

Install Python on PCs or through Mobile applications run basic Python Scripts for a given data.

Unit-II:

Control Flow-:if, if-elif-else, for, while, break, continue, pass

Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences, Comprehensions

Outcome:

- Understand the syntax of conditional statements in python
- Understand the syntax of Data Structures in python

Activity:

Identify Operators and types in Python. Implement Data Structure concepts by writing Python Scripts.

Unit-III:

Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Modules: Creating modules, import statement, from, name spacing,

Python packages Introduction to PIP, Installing Packages via PIP, Using Python Packages

Outcome:

- Understanding Functions implementation using Python.
- Learn the scope or life time of variables in a function.
- Usage of import statement in modules.
- Create a package, import and install PIP package in python

Activity: Using Functions develop simple scripts in Python Programming.

Unit-IV:

Object Oriented Programming OOP in Python: Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding,

Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions

Outcome:

- Implement the OOP concepts using python
- Understand the Exception handling in python

Activity: Implement OOP concepts in Writing Python Scripts

Unit-V

File handling:

Python File(doc and csv) Operation Reading config files in python, Writing log files in python, Understanding read functions, Understanding write functions, Manipulating file pointer using seek ,Programming using file operations Introduction to Standard libraries: NumPy, Pandas

Outcome:

Understand standard Libraries and GUI visualization in Python.

Activity: Write various test cases and implement specific test for a given case study.

Text Books:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Learning Python, Mark Lutz, Orielly
3. Complete Reference to Python – TMH-2018
4. Python Programming - Using Problem Solving Approach, Reema Thereja, Oxford University Press

Reference Books:

1. Think Python, Allen Downey, Green Tea Press
2. Core Python Programming, W.Chun, Pearson.
3. Introduction to Python, Kenneth A. Lambert, Cengage
4. http://nptel.ac.in/courses/117106113/34
5. https://www.python.org/

Course Code	SOFT COMPUTING TECHNIQUES	L	T	P	Credits
1004173205	(OPEN ELECTIVE-I)	3	1	0	3

Course Overview:

Soft computing is an emerging approach to computing which parallel the remarkable ability of the human mind to reason and learn in an environment of uncertainty and imprecision. Soft computing is the only solution when we don't have any mathematical modelling of problem solving (i.e., algorithm), need a solution to a complex problem in real time, easy to adapt with changed scenario and can be implemented with parallel computing.

Course Objectives:

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
- Introduce students to artificial neural networks and fuzzy theory from an engineering perspective

Course Outcomes:

After completion of the course students able to learn :

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Learn about soft computing techniques and their applications	Understand	PO2
CO2	Analyze various neural network architectures	Analyze	PO2, PO4, PO5
CO3	Understand perceptrons and counter propagation networks.	Understand	PO2
CO4	Analyze the genetic algorithms and their applications.	Analyze	PO2, PO4, PO5

Unit-I:

Introduction:

Approaches to intelligent control, Architecture for intelligent control, Symbolic reasoning system, Rule-based systems, the AI approach, Knowledge representation - Expert systems.

Outcome: Describe human intelligence and AI

Activity/Event : Group Discussion

Unit-II:

Artificial Neural Networks:

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron, Learning and Training the neural network, Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations, Hopfield network, Self-organizing network and Recurrent network, Neural Network based controller.

Outcome: Analyze various neural network architectures

Activity/Event: Seminar

Unit-III:

Fuzzy Logic System:

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning, Introduction to fuzzy logic modeling and control, Fuzzification, inferencing and defuzzification, Fuzzy knowledge and rule bases, Fuzzy modeling and control schemes for nonlinear systems, Self-organizing fuzzy logic control, Fuzzy logic control for nonlinear timedelay system.

Outcome: Define the fuzzy systems

Activity/Event: Write in detail about various Models.

Unit-IV:

Genetic Algorithm:

Basic concept of Genetic algorithm and detail algorithmic steps, Adjustment of free parameters, Solution of typical control problems using genetic algorithm, Concept on some other search techniques like Tabu search and an D-colony search techniques for solving optimization problems.

Outcome: Analyze the genetic algorithms and their applications.

Activity/Event: Think-Pair-Share(TPS)

Unit-V:

Applications:

GA application to power system optimization problem, Case studies: Identification and control of linear and nonlinear dynamic systems using MATLAB-Neural Network toolbox, Stability analysis of Neural-Network interconnection systems, Implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox, Stability analysis of fuzzy control systems.

Outcome: Develop some familiarity with current research problems and research methods in Soft Computing Techniques.

Activity/Event: By solving with matlab software.

Text Books:

1. Introduction to Artificial Neural Systems - Jacek.M.Zurada, Jaico Publishing House, 1999.
2. Neural Networks and Fuzzy Systems - Kosko, B., Prentice-Hall of India Pvt. Ltd., 1994.

Reference Books:

1. Fuzzy Sets, Uncertainty and Information - Klir G.J. &Folger T.A., Prentice-Hall of India Pvt. Ltd., 1993.
2. Fuzzy Set Theory and Its Applications - Zimmerman H.J. Kluwer Academic Publishers, 1994.
3. Introduction to Fuzzy Control - Driankov, Hellendroon, Narosa Publishers.
4. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
5. Elements of Artificial Neural Networks - KishanMehrotra, Chelkuri K. Mohan, Sanjay Ranka, Penram International.
6. Artificial Neural Network –Simon Haykin, 2nd Ed., Pearson Education.
7. Introduction Neural Networks Using MATLAB 6.0 - S.N. Shivanandam, S. Sumati, S. N. Deepa,1/e, TMH, New Delhi.

Course Code		L	T	P	Credits
1004173206	BIO MEDICAL INSTRUMENTATION (OPEN ELECTIVE-I)	3	1	0	3

Course Overview:

Biomedical instrumentation combines engineering principles with medical and biological sciences to design and create equipment, devices, computer systems, and software used in healthcare.

Course Objectives:

- Biomedical engineering education must allow engineers to analyze a problem from both an engineering and biological perspective
- To anticipate the special difficulties in working with living systems and to evaluate a wide range of possible approaches to solutions
- The undergraduate program in Biomedical Engineering provides a strong foundation in the basic sciences, mathematics, engineering and life sciences.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Man instrument system and types of electrodes and transducers to extract bio potential signals	Apply	PO1, PO2, PO3
CO2	Anatomy of heart, lungs, eye and ears. Devices to do tests on heart, lungs, eye and ears.	Understand	PO2, PO3, PO4, PO6
CO3	Diagnose & Monitor the health of patient in intensive care unit	Analyze	PO1, PO2, PO3, PO6, PO8
CO4	Monitors, recorders and electrical accident prevention methods	Apply	PO1, PO2, PO3, PO6, PO7

Unit-I:

Introduction to Biomedical Instrumentation:

Man Instrumentation System, Physiological System of the Body, Problems Encountered in Measuring a Living System, Sources of Bioelectric Potentials, Resting and Action Potentials, Bioelectric Potentials-ECG, EEG and EMG.

Electrodes and Transducers:

Introduction, Electrode Theory, Bio potential Electrodes, Examples of Electrodes, Basic Transducer Principles, Biochemical Transducers, The Transducer and Transduction Principles, Active Transducers, Passive Transducers, Transducers for Biomedical Applications, Pulse Sensors, Respiration Sensor, Transducers with Digital Output.

Outcome:

Able to explain Man instrument system & different electrodes to extract bioelectric potentials

Activity/Event: Explain about ECG, EMG and EEG

Unit-II:

Cardiovascular System and Measurements:

The Heart and Cardiovascular System, Electro Cardiography, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart Sound, Plethysmography.

Measurements in the Respiratory System:

The Physiology of The Respiratory System, Tests and Instrumentation for The Mechanics of Breathing, Respiratory Therapy Equipment.

Outcome: Learn anatomy and working of heart. Understand different about instruments to measure blood pressure, blood flow and lung volumes

Activity/Event: prepare a model of heart and demonstrate how heart works Assignment on spirometer and lung volumes

Unit-III:

Patient Care and Monitoring:

Elements of Intensive-Care Monitoring, Patient Monitoring Displays, Diagnosis, Calibration and Repair ability of Patient-Monitoring Equipment, Other Instrumentation for Monitoring Patients, Organization of the Hospital for Patient-Care Monitoring, Pacemakers, Defibrillators, Radio Frequency Applications of Therapeutic use.

Therapeutic and Prosthetic Devices:

Audiometers and Hearing Aids. Myoelectric Arm, Laparoscope, Ophthalmology Instruments, Anatomy of Vision, Electro physiological Tests, Ophthalmoscope, Tonometer for Eye Pressure Measurement. Diathermy, Clinical Laboratory Instruments, Biomaterials, Stimulators.

Outcome: Lear n about different equipment used to monitor the health of patient.
Understand equipments like pacemaker, audiometers, ophthalmoscope, Tanometer etc

Activity/Event: seminar onaudiometers, ophthalmoscope, Tanometer and diathermy

Unit-IV:

Diagnostic Techniques and Bio-Telemetry:

Principles of Ultrasonic Measurement, Ultrasonic Imaging, Ultrasonic Applications of Therapeutic Uses, Ultrasonic Diagnosis, X-Ray and Radio-Isotope Instrumentations, CAT Scan, Emission Computerized Tomography, MRI, Introduction to Biotelemetry, Physiological Parameters Adaptable to Biotelemetry, The Components of Biotelemetry System, Telemetry for ECG Measurements during Exercise, Telemetry for Emergency Patient Monitoring.
Outcome: Lear about different devices to diagnose the disease of the patient.. Learn about telemetry system to transmit bio medical signals like ECG, EEG etc

Activity/Event: presentation of MRI, CT scan, Ultrasonic imaging and X-Ray using graphic videos.

Unit-V:

Monitors, Recorders and Shock Hazards:

Biopotential Amplifiers, Monitors, Recorders, Shock Hazards and Prevention, Physiological Effects and Electrical Current, Shock Hazards from Electrical Equipment, Methods of Accident Prevention, Isolated Power Distribution System.

Outcome: Learn about different techniques to record and display signals. Learn about the ways to prevent shock hazards.

Activity/Event: Discussion on monitors, recorders and shock hazards

Text Books:

1. Bio-Medical Electronics and Instrumentation, Onkar N. Pandey, Rakesh Kumar, Katson Books, 1st edition, 2007.
2. Bio-Medical Instrumentation, Cromewell ,Wiebell, Pfeiffer, Prentice-hall, 2nd edition, reprint 2010.

Reference Books:

1. Introduction to Bio-Medical Equipment Technology, Joseph J. Carr, John M. Brown, Pearson Publications, 4th Edition, 2008.
2. Hand Book of Bio-Medical Instrumentation, R.S.Khandpur, McGrawHill, 2nd edition, 2002.

Course Code	JAVA PROGRAMMING (OPEN ELECTIVE-I)	L	T	P	Credits
1005173208		3	1	0	3

Course Overview:

- Java has emerged as the object-oriented programming language of choice.
- Some of the important concepts of Java include are:
    1. A Java virtual machine (JVM), which provides the fundamental basis for platform independence
    2. Automated storage management techniques, such as garbage collection, collection frameworks
    3. Language syntax that is similar to that of the C language.

Course Objectives:

- To Understanding the object oriented programming concepts like Data Abstraction,
- Encapsulation, Inheritance and Polymorphism.
- Gain the knowledge about the relationship between the classes and objects.
- Understand the principles of Inheritance, Packages, Multithreading and Interfaces.
- To understand and apply the concepts of Applets and AWT.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Identify the concepts and features of object oriented programming in Java.	Understanding	PO1, PO2
CO2	Describe and implement the programs with command line arguments and Scanner Class.	Analyzing	PO1, PO2, PO3,PO5
CO3	Analyze and implement the concepts of Inheritances and Multithreading with real world scenario.	Applying	PO1, PO2, PO3,PO5
CO4	Develop GUI programs using Applets and Event Handling.	Applying	PO1, PO2, PO3,PO5

Unit-I:

Introduction to OOP, procedural programming language and object oriented language, principles of OOP, applications of OOP, history of java, java features, JVM, program structure. Variables,

primitive data types, identifiers, literals, operators, expressions, precedence rules and associatively.

Outcome:

After reading this Unit, student should be able to understand:

- Be familiar with Object oriented programming techniques.
- Explain the structure of the program
- Demonstrate various control structures in JAVA.

Activity: Simulate various control structures for real time applications.

Unit-II:

Primitive type conversion and casting, flow of control, Abstract Data Type, Classes and objects, class declaration, creating objects, methods and method overloading, constructors and constructor overloading, garbage collector, importance of static keyword and examples.

Outcome:

After reading this Unit, student should be able to understand:

- Outline the relation between class and object.
- Illustrate the difference between method and constructor overloading.
- Make use of static keyword and this keyword.
- Analyze the Command Line arguments.

Activity: Develop real time applications using OOPs concepts through various ADT's.

Unit-III:

This keyword, arrays, command line arguments, nested classes. Inheritance, types of inheritance, super keyword, final keyword, overriding and abstract class. Interfaces, creating the packages, using packages, importance of CLASSPATH and java.lang package. Exception handling, importance of try, catch, throw, throws and finally block, user defined exceptions, Assertions, Collection inbuilt classes.

Outcome: After reading this Unit, student should be able to understand:

- Classify various types of Inheritance.
- Illustrate the difference between method overloading and overriding.
- Demonstrate to usage of Packages.
- Make use of Exception Handling.
- Develop and make use of synchronization through multithreading.

Activity: Develop enhanced applications from existing versions to new versions.

Unit-IV:

Multithreading: introduction, thread life cycle, creation of threads, thread priorities, thread Synchronization, communication between threads. Reading data from files and writing data to files.

Outcome: After reading this Unit, student should be able to understand:

- Explain the structure of Applet Program.
- Construct an approach for event delegation model.
- Build the frame based applications using event handling mechanism.

Activity: Develop client browser applications with Graphics

Unit-V:

Applet class, Applet structure, Applet life cycle, sample Applet programs. Event handling: event delegation model, sources of event, Event Listeners

Outcome:

After reading this Unit, student should be able to understand:

- Extend the importance of AWT.
- Develop the components and containers in AWT.
- Develop the GUI application using checkboxes, radio buttons, List Boxes etc.
- Construct different types of Layouts.

Activity:

Develop a client side module which contains checkboxes, text fields, text area, radio buttons etc.

Text Books:

1. The complete Reference Java, 8thedition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, Saurabh Choudary, Oxford.
3. Introduction to java programming, 7thedition by Y Daniel Liang, Pearson.

Reference Books:

1. Swing: Introduction, JFrame, JApplet, JPanel, Componets in Swings, Layout Managers in
2. Swings, JList and JScrollPane, Split Pane, JTabbedPane, JTree, JTable, Dialog Box.

Course Code		L	T	P	Credits
1004173221	**MICROPROCESSORSAND MICROCONTROLLERS LAB**	0	0	3	2

LIST OF EXPERIMENTS

PART- A: (Minimum of 5 Experiments has to be performed)

8086 Assembly Language Programs

1. Multi byte Addition/Subtraction, Multiplication and Division operations.
2. ASCII Arithmetic Operations & Code Conversions
3. Sum of Squares/Cubes of a given-numbers
4. Factorial of given-numbers
5. String Operations.
6. Sorting

PART- B: (Minimum of 3 Experiments has to be performed)

8051 Assembly Language Programs

1. Finding number of 1's and number of 0's in a given 8-bitnumber
2. Addition of even numbers from a given array
3. Ascending / Descending order
4. Average of-numbers

PART- C: (Minimum of 4 Experiments has to be performed)

Interfacing of I/O Devices

1. Hardware/Software Interrupt Application using 8086 & 8051
2. D/A Interface through Intel8255 to 8086 & 8051
3. Keyboard and Display Interface through Intel8279
4. Stepper Motor Interface to 8086 & 8051
5. Traffic Light Controller

Equipment Required:

1. Adapters
2. keyboards
3. Analog/Digital Storage Oscilloscopes
4. 8086 Micro processor kits
5. 8051 micro controller kits
6. DAC module
7. Stepper motor module
8. Traffic light module

Course Code		L	T	P	Credits
1004173222	**VLSI Lab**	0	0	3	2

The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the following experiments using 130nm technology with the Industry standard EDA Tools**.**

Minimum 10 experiments should be conducted

List of Experiments:

1. Design and Implementation of CMOS inverter
2. Design and Implementation CMOS NAND & NOR gates
3. Design and Implementation full adder
4. Design and Implementation full Subtractor
5. Design and Implementation of CMOS EXOR & EXNOR gates
6. Design and Implementation of gated SR latch and Dlatch
7. Design and Implementation of Decoder
8. Design and Implementation of Demultiplexer
9. Design and Implementation of CMOS SRAM
10. Design and Implementation of 3 bit asynchronous counter
11. Design and Implementation 4 bit R-2R ladder DAC
12. Design and Implementation differential amplifier

Software Required:

1. Mentor Graphics Software / Equivalent Industry Standard Software.
2. Personal computer system with necessary software to run the programs and to implement.

Course Code		L	T	P	Credits
1004173223	DIGITAL SIGNAL PROCESSING LAB	0	0	3	2

List of the Experiments / programs

To Student has to perform at least FIVE Experiments in each part

PART-1(SIGNALS)

1. Generation of discrete time signals for discrete signals
2. To verify the Linear Convolution
   a) Using MATLAB
   b) Using Code Composer Studio(CCS)
3. To verify the Circular Convolution for discrete signals
   a) Using MATLAB
   b) Using Code Composer Studio(CCS)
4. To Find the addition of Sinusoidal Signals
5. To verify Discrete Fourier Transform(DFT) and Inverse Discrete Fourier Transform(IDFT)
   a) Using MATLAB
   b) Using Code Composer Studio(CCS)
6. Transfer Function Stability Analysis: using pole-zero plot, bode plot, Nyquist plot, z-plane plot.

PART-2 (FILTERS)

7. Frequency Response of IIR low pass Butterworth Filter
8. Frequency Response of IIR high pass Butterworth Filter
9. Frequency Response of IIR low pass Chebyshev Filter
10. Frequency Response of IIR high pass Chebyshev Filter
11. Frequency Response of FIR low pass Filter using Window techniques
12. Frequency Response of FIR high pass Filter using Window techniques

Equipments & Software required:

1. Computer Systems with latest specifications.
2. Connected in LAN (Optional).
3. Operating system (Windows XP).
4. Simulations software (MATLAB)
5. DSP Trainer kit

PROGRAM STRUCTURE

FOR

IV-B.Tech

I & II SEMESTERS

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
PROGRAM STRUCTURE

IV B.Tech - I Semester

S.No	Course Code	Course Title	L	T	P	Credits
1	1004174101	Cellular and Mobile Communications	3	1*	0	3
2	1004174102	Digital Image Processing	3	1*	0	3
3	1004174103	Microwave Engineering	3	1*	0	3
4	1004174104	Optical Communications	3	1*	0	3
5	**Elective – I**		3	1*	0	3
	1004174105	e) IoT & its Applications				
	1004174106	f) System Design through Verilog				
	1004174107	g) Embedded Systems Design				
	1004174108	h) Global Positioning System(GPS)				
6	**Elective – II**		3	1*	0	3
	1004174109	e) Artificial Intelligence				
	1004174110	f) Speech Processing				
	1004174111	g) Micro Electromechanical Systems (MEMS)				
	1005172206	h) Operating Systems				
7	1004174121	Microwave engineering & Optical Communications Lab	0	0	3	2
8	1004174122	Digital Image Processing Lab	0	0	3	2
9	1099173101	IPR & patents	2	0	0	0
Total Credits						22

IV B.Tech II Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1	1004174201	Satellite Communications	3	1*	0	3
2	1004174202	Electronic Measurements and Instrumentation	3	1*	0	3
3	1004174203	Radar Systems	3	1*	0	3
4	**Elective – III**		3	1*	0	3
	1004174204	a) Data Science				
	1004174205	b) Low Power VLSI Design				
	1004174206	c) Wireless Communication and Networking				
	1004174207	d) Pattern Recognition				

(OR)						
	1004174281	Internship	0	0	0	12
5	1004174251	Technical Seminar	0	3	0	2
6	1004174261	Comprehensive Viva	0	0	0	2
7	1004174231	Main Project	0	0	0	10
					Total Credits	26

Course Code	CELLULAR MOBILE COMMUNICATIONS	L	T	P	Credits
1004174101		3	1	0	3

Course Overview: This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset. Students will learn concepts like frequency reuse, cell splitting, handoff procedures, frequency management, base stations, analog and digital systems and techniques need to deal with various facets of cellular and mobile communications.

Course Objectives:

- Demonstrate the applications of frequency reuse, cell splitting, etc., basic and operation of cellular system and digital cellular systems by applying the basics and concepts
- Enlighten different types of interferences influencing cellular and mobile communications.
- Explain the frequency management, channel assignment and various propagation effects in cellular environment.
- Compare types of handoffs and, architectures of GSM, 3G and 4G cellular systems

Course Outcomes:

After completion of the course students able to:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Explain the concepts, characteristics, principles and operation of cellular systems. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Understand Apply	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO2	Apply Concepts, principles to Co-channel interference Reduction factor, Desired C/I, directional Antenna system and Cell splitting. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Apply Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO3	Analyse Point to point model, other cell coverage of signal and traffic, frequency and channel assignment strategies. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO4	Analyse concepts of handoff and architectures of GSM, Technology comparison of 3G, 4G and 5G cellular systems. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12

Unit-I:

Introduction to Cellular Mobile Systems: A basic Cellular System, Performance Criteria, Uniqueness of Mobile Radio Environment, Operation of Cellular Systems, Planning a Cellular Systems, Analog-European Cellular Systems and Digital Cellular Systems

Outcome: Explain the operation of cellular systems with the concepts of mobile radio environment.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning

Unit-II:

Elements of Cellular Radio System Design: General description of the problem, Concept of Frequency Reuse Channels, Co-channel interference Reduction factor, Desired C/I from a normal case in an Omni directional Antenna system, Cell splitting.
Outcome: Apply Concepts to cell splitting, interference Reduction factor, and Desired C/I
Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning

Unit-III:

Interference: Introduction to Co-channel interference, Real time Co-channel interference, Design of Antenna system – omni directional antenna system in the worst case, Directional Antenna System, Diversity Receiver, Types of Non-Co-channel Interference- Adjacent channel Interference, Near – Far – end Interference, Long distance interference, UHF TV Interference.

Outcome: compare cochannel and non-cochannel interference, antenna system design antenna parameters.
Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

Unit-IV:

Frequency Management and Channel Assignment: Frequency management, Fixed Channels assignment, Non - Fixed Channel assignment, Traffic and Channel Assignment.

Cell Coverage for Signal and Traffic: General introduction, Obtaining the Mobile Point - to - Point model, Propagation over water or flat open area, Foliage loss, Point - to - Point predication model – characteristics.

Outcome: Compare fixed and nonfixed channel assignment and **e**xplain cell coverage for signal & traffic systems.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

Unit-V:

Hand Offs and Dropped Calls: Why Hand-Off, Initiation of a Hand Off, Two Types of Hand-Off, Delaying, Forced, Queuing, Power Difference, MAHO, Cell Site and Inter Systems Handoffs, Introduction to Dropped call rates.

Cell Site Antennas and Mobile Antennas: Antennas at Cell site, Mobile Antennas.
Digital Cellular Systems – Global system for Mobile – GSM Architecture

Outcome: Analyse handoff, architectures of GSM, summarisation of 3G, 4G and 5G systems.
Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

Text Books:

1. Mobile Cellular Telecommunications, W.C.Y. Lee, McGraw Hill International Edn., 2rd Edn.
2. Wireless Communications – Theodore. S. Rapport, Pearson Education, 2nd Edn., 2002.

Reference Books:

1. Mobile Cellular Communication, Gottapu Sasibhushana Rao, Pearson Education, 2012
2. Wireless Digital Communications by Dr. Kamilo Feher, PHI. 1995
3. Wireless Communication Technology – R. Blake, Thompson Asia Pvt. Ltd., 2004

Course Code	DIGITAL IMAGE PROCESSING	L	T	P	Credits
1004174102		3	1	0	3

Course Overview:

Digital image fundamentals- Relationships between pixels-Image Transforms- Histogram processing- Image smoothing- Image sharpening-Image Restoration-Image Segmentation-Image Compression-Color Image Processing.

Course Objectives:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement).
  Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation).
- Assess the performance of image processing algorithms and systems (colour and morphological).

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Summarize the fundamentals of gray scale and color image processing.	Understand	PO2, PO4, PO5
CO2	Apply different transforms and compression methods on image for image processing applications.	Apply	PO 1,PO 2, PO 4,PO 6
CO3	Analyze the methods to extract information from the image in terms of spatial filtering, frequency filtering, restoration and segmentation.	Analyze	PO 1,PO 2, PO 4,PO 6
CO4	Examine the different techniques of color and multi resolution processing.	Analyze	PO1, PO2, PO4,PO5

Unit-I:

Evolution of Digital image processing , Examples of fields that use digital image processing, Fundamental steps of digital image processing, Components of an image processing system, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between pixels.

Outcome:

- Explain mathematical models of various types of image concepts
- Define image sampling and quantization in image processing.

Activity/Event: Seminar

Unit-II:

IMAGE TRANSFORMS: Orthogonal Sinusoidal Basis Function – Discrete Fourier Transform, Discrete Cosine Transform **Non-sinusoidal orthogonal basic function** - Haar, Walsh, Hadamard, Slant. **Statistics of input signal**- KL transform, Singular Value Decomposion

Outcome:

- Demonstrate types of Image transforms
- Applying Image transforms to real time applications.

Activity/Event: Executing programs using MATLAB software.

Unit-III:

Image Enhancement: Need for Image Enhancement, Histogram Process.

Image Enhancement in Spatial domain: spatial filtering, smoothing low pass filter, sharpening high pass filter

Image Enhancement in Frequency domain: Image smoothing using low pass, Image sharpening using high pass filter.

Image Restoration techniques: A model of the image degradation/restoration process, Noise models, Restoration in presence of noise: Mean filters, Adaptive filters, Inverse filter, Wiener filter.

Outcome:

- Describe various spatial and time domain techniques in filtering.
- Illustrate detection of restoration and degradation with noise recognition.

Activity/Event: Executing programs using MATLAB software.

Unit-IV:

Image Compression: Need for image compression, Huffman coding, Arithmetic coding, LZW coding, Run-length coding, Block Transform coding, Predictive coding (lossless and lossy). Image standards (JPEG, MPEG, GIF).

Image Segmentation: Fundamentals, Point, Line and Edge detection, Region based segmentation, Edge detection, Edge linking, Thresholding.

Outcome:

- Describe various region and edge detection concepts
- Apply various compression techniques in real time applications.

Activity/Event: Executing programs using MATLAB software.

Unit-V:

Color Image Processing: Color fundaments, Pseudocolor image processing, Basic of full color image processing, Color image smoothing and sharpening, Using color in image segmentation, Noise in color images, Color image compression.

Outcome:

- Describe various colour models
- Apply various techniques for color image processing

Activity/Event: Executing programs using MATLAB software.

Text Books:

1. "Digital image processing", Gonzalez, R. C., and R. Woods. 4th Edition." (2018).
2. "Digital image processing", Jayaraman, S., S. Esakkirajan, and T. Veerakumar, TMH publication. Year of Publication (2009).

Reference Books:

1. "Digital image processing using MATLAB", Gonzalez, Rafael C., Richard Eugene Woods, and Steven L. Eddins, Pearson Education India, 2020.
2. "Fundamentals of Digital Image Processing", Sharma, Dr Sanjay, SK Kataria and Sons, 2008.

Course Code		L	T	P	Credits
1004174103	**MICROWAVE ENGINEERING**	3	1	0	3

Course Overview:

The course is helpful in designing of Antenna for wireless communication. As it clearly explains about the mode, scattering parameter, feeding mechanism all these parameter are used for designing of Antenna.

Course Objectives:

The student will

• Understand fundamental characteristics of waveguides and Microstrip lines through electromagnetic field analysis.

• Understand the basic properties of waveguide components and Ferrite materials composition

• Understand the function, design, and integration of the major microwave components oscillators, power amplifier.

• Understand a Microwave test bench setup for measurements.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Analyze the different modes of rectangular and circular waveguides	Analyze	PO1,PO2,PO3,PO4
CO2	Examine different microwave components and analyze different type of coupling mechanism	Analyze	PO1,PO2,PO4,PO10
CO3	Explain the working principles of microwave tube.	Evaluate	PO1,PO2,PO3,PO4,PO5
CO4	Explain the microwave solid state device	Evaluate	PO1,PO2,PO3,PO4,PO5

Unit-I:

MICROWAVE TRANSMISSION LINES:

Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations; Power Transmission and Power Losses in Rectangular Guide, Impossibility of TEM mode. Related Problems.

Unit-I Outcome:

Understand the significance of Microwave signals and its applications. Know about Rectangular

waveguide describe various modes in wave guide.

Activity/Event on Unit-1: Implement one transaction paper on rectangular waveguide

Unit-II:

CIRCULAR WAVEGUIDES:

Introduction, Nature of Fields, Characteristic Equation, Dominant and Degenerate Modes. Cavity Resonators– Introduction, Rectangular and Cylindrical Cavities, Dominant Modes and Resonant Frequencies, Q factor and Coupling Coefficients, Excitation techniques- waveguides and cavities, Related Problems.

Unit-II Outcome: Know about circular waveguide and cavity resonator describe various modes in wave guide.

Activity/Event on Unit-II: Implement one transaction paper on rectangular and cylindrical cavity

Unit-III:

MICROWAVE TUBES:

Microwave tubes – O type and M type classifications. Cavity Klystrons – Structure, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for o/p Power and Efficiency, Applications, Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Mathematical Theory of Bunching, Power Output, Efficiency, Electronic Admittance, Related Problems.

Unit-III Outcome: Explain the working principles of Tube type Microwave sources and its applications and advantages.

Activity/Event on Unit-III: determine the characteristic of reflex klystron in hardware

Unit-IV:

WAVEGUIDE COMPONENTS AND APPLICATIONS:

Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide irises, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Resistive Card, Rotary Vane types; Waveguide Phase Shifters – Dielectric, Rotary Vane types.

Scattering Matrix– Significance, Formulation and Properties. S-Matrix Calculations for – 2 port Junction, E-plane and H-plane Tees, Magic Tee, Hybrid Ring; Directional Couplers– 2Hole, Bethe Hole types, Ferrite Components– Faraday Rotation, Related Problems.

Unit-IV Outcome: understand the coupling mechanism and scattering matrix

Activity/Event on Unit-IV: evaluate the scattering parameter

Unit-V:

MICROWAVE SOLID STATE DEVICES:

Introduction, Classification, Applications. TEDs – Introduction, Gunn Diode – Principle, RWH Theory, Characteristics, Basic Modes of Operation, Oscillation Modes. Avalanche Transit Time Devices – Introduction, IMPATT and TRAPATT Diodes – Principle of Operation and

Characteristics.

Unit-V Outcome: understand the Microwave solid state-Devices.

Activity/Event on Unit-V: Implement IMPATT diode

Text Books:

1) Kulkarni, Muralidhar. *Microwave and radar engineering*. Vol. 17. Umesh Publications, New Delhi, 2009.
2) Rao, Gottapu Sasibhushana. *Microwave and radar engineering*. Pearson Education India,2014.

Reference Books:

1) Pozar, David M. *Microwave engineering*. John wiley& sons, 2009.
2) Raju, G. S. N. *Microwave engineering*. IK International Publishing House, 2008.
3) Liao, Samuel Y. *Microwave devices and circuits*. Pearson Education India, 1989.

Course Code	OPTICAL COMMUNICATIONS	L	T	P	Credits
1004174104		3	1	0	3

Course Overview:

This course provides in-depth knowledge of Optical Communications which is the basis for design of any Optical communication system.

Course Objectives:

The main objectives are

- The properties of optical fiber that affect the performance of a communication link and types of fiber materials with their properties and the losses occur in fibers.
- The principles of single and multi-mode optical fibers and their characteristics
- Working of semi conductor lasers, and differentiates between direct modulation and external electro-optic modulation.
- Analyze the operation of LEDs, laser diodes, and PIN photo detectors (spectral properties, bandwidth, and circuits) and apply in optical systems.
- Analyze and design optical communication and fiber optic sensor systems.
- The models of analog and digital receivers.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Select necessary components required in modern optical communications systems and learn fiber characteristics	Remember/Understand	PO1,PO2
CO2	Design and learn how to calculate electromagnetic modes in waveguides, various losses in an optical system, dispersion of optical fibers.	Understand/ Analyze	PO2,PO3,PO4,PO5,PO8
CO3	Use different types of photo detectors and optical test equipment to analyze optical fiber and light wave systems.	Understand/ Analyze	PO1,PO2,PO3,PO8
CO4	Design, build, and demonstrate optical fiber communication system with budget analysis and performance characteristics.	Understand/Analyze/ Design	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO12

Unit-I:

Overview of optical fiber communication – Historical development, The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, Cylindrical fibers- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index, Related problems.

Outcome: Select necessary components required in modern optical communications systems and learn fiber characteristics

Activity/Event: Calculate fiber optic specifications for different types of fiber

Unit-II:

Fiber materials: Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacity determination, Group delay, Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber, Related problems.

Outcome: Design and learn how to calculate electromagnetic modes in waveguides, various losses in an optical system, dispersion of optical fibers.

Activity/Event: Calculate dispersion and losses for the given fiber type

Unit-III:

Optical fiber Connectors-Connector types, Single mode fiber connectors, Connector return loss, Fiber Splicing- Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss-Multimode fiber joints, single mode fiber joints.

Source to fiber power launching – Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling.

Outcome: Learn how to calculate electromagnetic modes in waveguides, various connectors in an optical system, dispersion of optical fiber connectors and losses.

Activity/Event: Different types of connectors and their connecting procedure for fibers in real time

Unit-IV:

Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies, Reliability of LED&ILD, Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors, Related problems.

Outcome: Use different types of photo detectors and optical test equipment to analyze optical fiber and light wave systems.

Activity/Event: Verify the working of optical sources in real time

Unit-V:

Optical Receiver - Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit, Analog receivers.

Optical system design – Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples, Line coding in Optical links, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion, Eye pattern.

Outcome: Design, build, and demonstrate optical fiber communication system with budget analysis and performance characteristics.

Activity/Event: Design the comlete optical link for the given specifications

Text Books:

1. "Optical Fiber Communications" – Gerd Keiser, Mc Graw-Hill International edition, 3rd edition, 2000.
2. "Optical Fiber Communications" – John M. Senior, PHI, 2nd Edition, 2002.

Reference Books:

1. "Fiber Optic Communications" – Joseph C. Palais, Pearson Education, 4th edition, 2004.
2. "Fiber Optic Communication Systems" – Govind P. Agarwal, John Wiley, 3rd edition, 2004.

Course Code	INTERNET OF THINGS AND ITS APPLICATIONS (Elective-I)	L	T	P	Credits
1004174105		3	1	0	3

Course Overview: The purpose of this course is to impart knowledge on IoT Technology and Architecture, Internal communication protocols, corrections with other technologies, real time applications ad study practical design and implementation issues

Course Objectives: The main objective of course make student to understand the IoT basic concepts, standards, communication protocols, technological relation and real time applications and their design, implementation and deployment issues.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	To Understand the Architecture, protocols and applications of IoT.	Understand	PO1
CO2	To Analyse the communication protocols and standards used in IoT	Analyse	PO2
CO3	To analyse and design the simple IoT applications to monitor or control IoT devices using simulation or hardware	Design and Creative thinking	PO3, PO6, PO7
CO4	To implement the real time IoT applications.	Design and Deployment	PO4, PO5, PO11, PO12

Unit-I:
Introduction to IoT, Need of Internet of Things, Internet of Things ERA, Characteristics of Internet of Things, architectural view of Internet of Things, Technologies behind Internet of Things – Server- End Technology – Major Components of IoT system – Development Tools – API and device interfacing components, Sources of IoT, Examples of IoT – Smart Watch – Smart Home – Smart Phone.

Outcome: Understand the characteristics, physical and logical of IoT and their application.

Activity/Event: Identify physical and logical components involved in IoT applications

Unit-II:
Introduction, Generic computing systems Vs. Embedded systems, Purpose of Embedded Systems - Typical Embedded System – Core of the Embedded System – Memory – Sensors and Actuators with I/O subsystems – Communication Interfaces – Wireless Interfaces and Wire Interfaces – Characteristics of Embedded Systems – Quality Attributes of an Embedded Systems.

Outcome: Analyze and design hardware and software components of IoT application

Activity/Event: Identification day to day embedded devices along with hardware and software components

Unit-III:

M2M communication – M2M to IoT – M2M architecture – software development tools, Communication Technologies – Wireless communication technologies – Wired Communication, Physical Design of IoT – Things in IoT – IoT Protocols, Logical design of IoT – IoT functional blocks – IoT communication models.

Outcome: Analyze and design the communication protocols of IoT applications

Activity/Event: Identification of communication styles of various IoT Protocols

Unit-IV:
Basic building blocks of an IoT devices, Introduction about the Raspberry Pi Board, Operating systems for Raspberry Pi, Interfaces for IoT – Serial Interface – SPI – I2C, IoT Design Methodology – Requirements – Process – Domain Model – Information model – service – Functional View – Operational View – Device & components Integration – Application development.

Outcome: Construction of IoT systems with raspberry pi and simulation tools
Activity/Event : Hands-on setup of IoT Systems using Raspberry pi

Unit-V:

Case Studies: Home Automation – Smart lighting – Home intrusion detection, Cities – smart parking, Environment – Weather monitoring system – Air Pollution Monitoring – Forest Fire Detection, Agriculture – smart irrigation system.

Outcome: Understand physical and logical aspects of real time IoT applications.

Activity/Event: Mini project on IoT applications for monitoring/control devices

Text Books:

01. Internet of Things: A Hands-On Approach, ArshdeepBahga, Vijay Madisetti, 2014 edition, University Press.
02. The Internet of Things: Enabling technologies, Platforms and Use cases, Pethuru Raj and Anupama C. Raman, 2017 edition, CRC Press, Taylor and Francis Group.
03. Introduction to Embedded Systems, Shibu K V, 2nd Edition, Tata Mc-Graw hill Edition.

Reference Books:

01. Internet of Things: Architecture and design Principles, Raj Kamal, Tata Mc-Graw hill Edition.
02. Embedded Systems: Architecture and applications, Raj Kamal, Tata Mc-Graw hill Edition.

Course Code	SYSTEM DESIGN THROUGH VERILOG (Elective-I)	L	T	P	Credits
1004174106		3	1	0	3

Course Overview:

This course covers the use of Verilog and System verilog Languages (IEEE Std. 1800) for the design and development of digital integrated circuits, including mask-programmed integrated circuits (ASICs) and field programmable devices (FPGAs). Hierarchical top down vs. bottom up design, synthesizable vs. non-synthesizable code, design scalability and reuse, verification, hardware modelling, simulation system tasks, compiler directives and subroutines are all covered and illustrated with design examples.

Course Objectives:

- The ability to code and simulate any digital function in Verilog HDL.
- Know the difference between synthesizable and non-synthesizable code.
- Understand library modelling, behavioral code and the differences between them.
- Learn good coding techniques per current industrial practices.
- Understand logic verification using Verilog simulation.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	To describe Verilog hardware description languages and able to Design Digital Circuits in Verilog HDL	Understanding	PO1,PO2
CO2	Model digital systems at highest level of abstractions like behavioural modelling	Understanding	PO3,PO5
CO3	Model complex digital systems at lower levels of abstractions like Dataflow and switch level	Applying	PO4,PO5
CO4	Analyze and design basic digital circuits with combinatorial and sequential logic circuits using Verilog	Analyzing	PO3,PO5

Unit-I:

INTRODUCTION TO VERILOG:

Verilog as HDL, Levels of design description, concurrency, simulation and synthesis, functional verification, system tasks, programming language interface (PLI), module, simulation and synthesis tools, test benches.

LANGUAGE CONSTRUCTS AND CONVENTIONS:
Introduction, keywords, identifiers, whitespace characters, comments, numbers, strings, logic values, data types, scalars and vectors, parameters, memory, operators, system tasks.
Outcome: Learn basics of Verilog programming and will be able to describe circuit in Verilog

Activity/Event: To program small designs in Verilog using Xilinx software

Unit-II:

GATE LEVEL MODELLING:
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, delays, strengths and contention resolution, net types, design of basic circuits.

Outcome: Learn to design various circuits at gate level and study their behaviour

Activity/Event: Design full adder, decoder and flip flops in gate level, write Verilog program and simulate the design in modelsim

Unit-III:

BEHAVIORAL MODELLING:
Introduction, operations and assignments, functional Bifurcation, initial construct, always construct, examples, assignments with delays, wait construct, multiple always blocks, designs at behavioural level, blocking and non-blocking assignments, the case statement, simulation flow, if and if else constructs, assign-De assign construct, repeat construct, FOR loop, the disable construct, While loop, Forever loop, parallel blocks, force-release construct, Event.

Outcome: learn to describe the design in Verilog using behavioural elements like if statement, case statement and different kinds of loop statements

Activity/Event: Design traffic light controller in Verilog using behavioural elements

Unit-IV:

DATAFLOW LEVEL AND SWITCH LEVEL MODELLING:
Introduction, continuous assignment structures, delays and continuous assignments, assignment to vectors, basic transistor switches, CMOS switch, Bidirectional gates and time delays with switch primitives, instantiations with strengths and delays, strength contention with trireg nets.

Outcome: Learn to describe the design in dataflow model and will able to design the circuit in switch level using transistors

Activity/Event: To design flipflops using dataflow elements and seminar on designing some complex functions in transistor level

Unit-V:

SYNTHESIS OF COMBINATIONAL AND SEQUENTIAL LOGIC USING VERILOG:
Synthesis of combinational logic: Net list of structured primitives, a set of continuous assignment statements and level sensitive cyclic behaviour with examples, Synthesis of priority structures, Exploiting logic don't care conditions. Synthesis of sequential logic with latches:

Accidental synthesis of latches and Intentional synthesis of latches, Synthesis of sequential logic with flip-flops, Synthesis of explicit state machines.

Outcome: learn to synthesize and understand about hardware used in modelling combinational and sequential circuits

Activity/Event: To synthesize Arithmetic logic unit and counters in Verilog

Text Books:

1. "Design through Verilog HDL", T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, IEEE Press, 2004.
2. "Advanced Digital Design with Verilog HDL" Michael D. Ciletti, PHI, 2005.

Reference Books:

1. "Fundamentals of Logic Design with Verilog" – Stephen. Brown and ZvonkoVranesic, TMH, 2005.
2. "A Verilog Primier", J. Bhasker, BSP, 2003.

Course Code	EMBEDDED SYSTEMS DESIGN (Elective-I)	L	T	P	Credits
1004174107		3	1	0	3

Course Overview: The purpose of this course is to impart knowledge on the fundamentals of embedded system hardware and firmware design will be explored. Issues such as embedded processor selection, hardware/firmware partitioning, circuit design, circuit layout, circuit debugging, Real-Time Operating Systems, firmware architecture, design and debugging will be discussed.

Course Objectives:

The main objective of course make student to understand the Embedded Systems basic concepts, standards, Hardware and Firmware design and real time operating systems with applications and their design, implementation and deployment issues.

Course Outcomes:

	Course Outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Understand the basic concepts and hardware components of an embedded system and able to know the design approach to perform a specific function.	Understand	PO-1, PO-2,
CO2	The hardware components required for an embedded system and the design approach of an embedded hardware.	Analyze	PO-1, PO-2, PO-3, PO-12
CO3	The various embedded firmware design approaches on embedded environment.	Design and Creative thinking	PO-1, PO-2, PO-3, PO-5, PO-12
CO4	Understand how to integrate hardware and firmware of an embedded system using real time operating system.	Design and Deployment	PO-1, PO-2, PO-3,PO-4, PO-12

UNIT-I: INTRODUCTION: What is an Embedded System, Embedded System Vs. General Computing System, Classification, Purpose of Embedded systems, Core of Embedded System – Microprocessors, Microcontrollers, Microprocessors Vs. Microcontrollers, ASICs, PLDs, COTS, Memory – RAM and ROM, Sensors and Actuators – I/O Subsystems.

Outcome: Understand the basic concepts of an embedded system.

Activity: Literature survey on Core of the embedded systems with the help of research

journals with professional ethics, team work and self-learning.

UNIT-II: EMBEDDED HARDWARE DESIGN: Characteristics and Quality attributes of embedded systems, Analog and Digital electronic components, Application and domain specific embedded systems, Communication Interface – Wire and Wireless Interfaces, Timer and Counting Devices, Watchdog timer, Real time clock.

Outcome: The hardware components required for an embedded system and the design approach of an embedded hardware.

Activity: Consider anyone of the interface, and monitor how it's working for communication interface.

UNIT-III: EMBEDDED SOFTWARE DESIGN: Embedded Firmware design approaches, Embedded firmware development languages, Direct Memory Access, Concepts of C versus Embedded C and compiler versus Cross-compiler.

HARDWARE SOFTWARE CODESIGN: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware Software Trade – Offs.

Outcome: The software components required for an embedded system and the design approach of an embedded software.

Activity: Study anyone of the embedded system design with hard - software and analyze it.

UNIT-IV: REAL – TIME OPERATING SYSTEMS: Introduction, operating system basics, Types of RTOS, Tasks, Process and Threads, Multiprocessing and multitasking, Types of multitasking, Task Scheduling: Non-Preemptive and Preemptive Scheduling algorithms, Semaphore and Mutex, How to clause an RTOS.

Outcome: Understand how to integrate hardware and firmware of an embedded system using real time operating systems.

Activity: Study the tasking and multitasking procedures with algorithms.

UNIT – V: SCOPE OF EMBDDED SYSTEMS IN INDUSTRIES

Introduction to AVR (ATMEGA series, ATMEGA 128, ATMEGA 328p, ATMEGA2560),CISC vs. RISC, block diagram, architecture, pin description, I/O peripherals, embedded programming for I/O devices, ADC,**Case Studies**: Temperature display system, Real time clock display in LCD using RTC, Smartphone operated home automation

Outcome: Understand the designing procedure and approaches of an embedded system.

Activity: Literature survey on ATMEGA SERIES approaches with the help of research Journals with professional ethics, team work and self-learning.

TEXT BOOKS:

1. Introduction to Embedded Systems, SHIBU K V, Tata Mc-Graw Hill Edition.
2. Embedded Systems: Architecture, Programming and Design, RAJKAMAL, TMH Edition.

REFERENCE BOOKS:

01. Embedded Software Primer by David Simon, Pearson Publications.

02. Embedded System Design by Frank Vahid & Tony Givargis, John Wiley & Sons.

Course Code	GLOBAL POSITIONING SYSTEM (GPS) (Elective-I)	L	T	P	Credits
1004174108		3	1	0	3

Course Overview: This course will introduce students to this rapidly growing field and equip them with some of its basic principles and applications of GPS. Enlighten different types GPS architectures, the geometric and covariance analysis, Observation data and navigation message data parameters.

Course Objectives:

- Explain principles of and applications of GPS by applying the basics and concepts
- Enlighten different types GPS architectures
- Explain the geometric, covariance analysis, GPS/INS Integration architecture.
- Analyse Observation data and navigation message data parameters.

Course Outcomes:

After completion of the course students able to:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Explain the concepts, developments of block type GPS Satellites, principles and operation of GPS and Determining the receiver position in 2D, 3D Plane. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Understand Apply	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO2	Apply Concepts, principles to GPS velocity calculations and Geo-augmented navigation (GAGAN) architecture. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Apply Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO3	Analyse geometric, covariance analysis, and GPS/INS integration architectures. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO4	Analyse Observation data and navigation message data parameters. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12

Unit-I:

Introduction to Global Navigation Satellite Systems (GNSS):

The History of GPS, The Evolution of GPS, Development of NAVSTAR GPS, Block I, Block II satellites, Block IIA, Block IIR and Block II R-M satellites, GPS working principle, Trilateration, Determination of where the satellites are, Determination of how far the satellites are, Determining the receiver position in 2D or XY Plane, Determining the receiver position in 3D or X-Y-Z Plane.

Outcome: Explain the concepts, developments of block type GPS Satellites, principles and operation of GPS and Determining the receiver position in 2D, 3D Plane.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning

Unit-II:GPS Satellite Constellation and Signals:

GPS system segments, Space segment, Control segment, User segment, GPS Signals, Pseudorandom noise (PRN) code, C/A code, P code Navigation data, Signal structure of GPS.

Outcome: Apply Concepts to GPS Satellite Constellation and Signals. Apply Concepts, principles of GPS velocity calculations and Geo-augmented navigation (GAGAN) architecture.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning

Unit-III:

GAGAN architecture:

System architecture, GPS and GLONASS Overview, Satellite Navigation, Time and GPS, User position and velocity calculations, GPS aided Geo-augmented navigation (GAGAN) architecture.

Signal Characteristics: GPS signal components, purpose, properties and power level, signal acquisition and tracking, Navigation information extraction, frequency estimation, GPS satellite position calculation, Difference between GPS and GALILEO satellite construction.

Outcome: User position and velocity calculation, Compare GPS and GALILEO Construction.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

Unit-IV:

Differential GPS: Introduction, LADGPS, WADGPS, Wide Area Augmentation systems, GEO Uplink subsystem, GEO downlink systems, Geo Orbit determination, Geometric analysis, covariance analysis, GPS /INS Integration Architectures.

Outcome: Analyse geometric and covariance analysis, and GPS/INS integration architectures.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

Unit-V:

GPS Applications: GPS in surveying, Mapping and Geographical Information System, Precision approach Aircraft landing system, Military and Space application, intelligent transportation system. GPS orbital parameters, description of receiver independent exchange format (RINEX), Observation data and navigation message data parameters, GPS position determination, least squares method.

Outcome: Analyse Observation data and navigation message data parameters

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

Text Books:

1. Global positioning systems, Inertial Navigation and Integration, Mohinder S. Grewal, Lawrence R.Weill, Angus P. Andrews Wiley 2007.
2. Global Navigation Satellite Systems, Gottapu Sasibhushana Rao, McGraw-Hill Publications, New Delhi, 2010.

Reference Books:

1. Understanding GPS Principles and Applications, E.D.Kaplan, Christopher J. Hegarty, Artech House Boston 2005.

Course Code	ARTIFICIAL INTELLIGENCE (Elective-II)	L	T	P	Credits
1004174109		3	1	0	3

Course Overview:

This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset. Students will learn concepts, techniques and tools they need to deal with various facets of artificial intelligence developments of 2016, models of ANNandPerception and Learning, Multilayer Neural Networks, Machine Learning, Three Basic Machine Learning, Algorithms.

Course Objectives:

- Demonstrate self-driving cars
- Describe biggest artificial intelligence developments of 2016.
- Enlighten models of ANN and perception and learning.
- Identify and Analyse Multilayer Neural Networks and Three Basic Machine Learning, Algorithms.

Course Outcomes: After completion of the course students able to:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Explain the of the Field of Artificial Intelligence from general AI to self-driving cars. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Understand Apply	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO2	Describe the biggest artificial intelligence developments of 2016, A.I is becoming more capable of imitating humans, **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Apply Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO3	Analyse different models of ANN **and** Perception and Learning. **Submit Review report as a self-learning and team work and**	Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO4	Analyse Multilayer Neural Networks and Three Basic Machine Learning, Algorithms. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12

Unit-I:

Artificial Intelligence: Artificial Narrow Intelligence, Artificial General Intelligence, Artificial Super Intelligence, real life A.I (examples), From general AI to self-driving cars, strong A.I, weak A.I, The future of A.I, Benefits of A.I., An Overview of the Field of Artificial Intelligence.

Outcome: Explain from general AI to self-driving cars.
Activity/Event: Case study: Smart speaker / Self-driving car

Unit-II:

The biggest artificial intelligence developments of 2016:AI conquered more than just another board game, AI is taking baby steps in fighting cyber-attacks, A.I is becoming more capable of imitating humans, A.I becomes the source of more privacy headaches, We're now closer to general AI, It's an exciting time for AI.

Unit-II Outcome: Describe the biggest artificial intelligence developments of 2016

Activity/Event: Case study: Survey of major AI application areas.

Unit-III:

Artificial Neural Networks: Human recognition system, Machine recognition, **Artificial** Neural Network, Activation functions, different models of ANN: Feed forward network, feedback network, Neural Learning; Perception and Learning: The minimum squared error criterion, perception and linearly separable tasks, modelling AND, OR, gate and problems in modelling XOR gate, limitations of a perceptron, The MSE learning for multiple outputs.

Outcome: Explain different models of ANN **and** Perception and Learning.
Activity/Event: Group discussion and seminar

Unit-IV:

Multilayer Neural Networks: Learning in Multi-Layer Perceptron's, Implementation Parameters: Training data, Network size, weights and learning rate, Self-Organization Map: Learning in SOM, Learning Vector Quantization (LVQ).

Outcome: Explain implementation parameters of multilayer neural networks.

Activity/Event: Case study: Survey of major AI techniques /AI and jobs

Unit-V:

Machine Learning: What is machine learning? What is deep learning? Challenges of machine learning? Types of machine learning, Supervised, Unsupervised and Reinforcement learning, Supervised: Classification, Regression. Unsupervised: Clustering

Three Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbours (k-NN), k-means.

Outcome: Explain Linear Regression, k-Nearest Neighbours (k-NN), k-means ML Algorithms

Activity/Event: Case study: Philosophy, Ethics, and Safety of AI

Text Books:

1. Fundamentals of New Artificial Intelligence, ThoshinoriMunakata, Spriger Publisher, 2nd Edition. India, 2011
2. Digital Image Processing and Pattern Recognition, Malay K. Pakhira, PHI Learning.2011

Reference Books:

1. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, Prentice-Hall, Inc., 1995.
2. Introducing Artificial Intelligence: A Graphic Guide, By Henry Brighton, Icon Books Ltd, 2012.
3. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective 2012, Massachusetts Institute of Technology.

Course Code	SPEECH PROCESSING (Elective-II)	L	T	P	Credits
1004174110		3	1	0	3

Course Overview: students can able to understand the knowledge on speech production and perception along with processing of speech signal.

Course Objectives:

1. Familiarize with the fundamentals of speech processing
2. Familiarize with models for speech analysis and perception
3. Understand frequency and time-frequency analysis of speech signal.
4. Develop the ability to calculate features and fundamental frequency of speech signal.
5. Familiarize with basic speech coding techniques, like pitch extraction, spectral analysis

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Record, analyze, characterize, modify, and synthesize speech (and other vocal) signals.	Understand	PO1, PO2, PO3, PO4
CO2	Analysis and synthesis of speech using different technologies, explain how they work, and discuss their strengths and limitations.	Apply	PO1, PO2, PO3, PO4, PO11
CO3	Explain the working principles of Tube type Microwave sources and its applications and advantages.	Apply	PO1, PO2
CO4	Applications of different Speech methods (TTS, ASR and spoken language acquisition)	Analyze	PO1, PO6

Unit-I:

Introduction: speech production and perception, information sources in speech, linguistic aspect of speech, acoustic and articulatory phonetics, nature of speech, models for speech analysis and perception.

Outcome:

Understand the Model speech production system and describe the fundamentals of speech.

Activity/Event: Study the properties of most frequent two or three syllables in the English language.

Unit-II:

Short-term processing: Need, approach, time, frequency and time-frequency analysis; Short-term Fourier transform (STFT): overview of Fourier representation, non-stationary signals, development of STFT, transform and filter-bank views of STFT.
Outcome: Explain the STFT and its applications and advantages

Activity/Event: Using STFT find the frequency domain properties of speech

Unit-III:

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.
Outcome: Explain the Features, Feature Extraction and Pattern Comparison Techniques

Activity/Event: Exact the features of given English sentence.

Unit-IV:

Speech Modeling: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, and Implementation issues.
Outcome: explain the Hidden markov model

Activity/Event: Measured the issues related to implementation of speech

Unit-V:

Speech coding: Need and parameters, classification, waveform coders, speech-specific coders, GSM, CDMA and other mobile coders; Applications: Some applications like pitch extraction, spectral analysis and coding standard.

Outcome: Explain the applications of speech coding.

Activity/Event: Voiced/Unvoice Classification of Speech with Applications

Text Books:

1. "Theory and Applications of Digital Speech Processing", Lawrence Rabiner and Ronald Schafer, Prentice-Hall, 2011.

Reference Books:

1. Discrete-Time Speech Signal Processing, T.F. Quatieri, Prentice-Hall, 2002
2. "The Scientist and Engineer's Guide to Digital Signal Processing", Steven W. Smith, California Technical Publishing.
3. Springer Handbook of Speech Processing, Benetsy, M.M. Sondhi, Y. Huang (eds.), Springer-Verlag, 2008.
4. Discrete-Time Processing of Speech Signals, J.R. Deller, J.H.L. Hansen, and J.G. Proakis, Wiley India Pvt. Ltd., 2000.

Course Code	MICRO ELECTRO MECHANICAL SYSTEMS (MEMS) (Elective-II)	L	T	P	Credits
1004174111		3	1	0	3

Course Objectives: This course provides the knowledge on Importance of Miniaturization and its applications in various domains, Scalable rules in the process of miniaturization for different fields of applications, various MEMS design methodologies, modelling of MEMS devices that combine multiple disciplines of Engineering, Consideration of MEMS design challenges on the device level, system level and packaging level.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	**U Interpret** the role of miniaturization in microelectronic devices and scaling rules of MEMS**.**	Understand	PO1, PO2
CO2	**D Articulate** the techniques for building the microelectronic devices on various types materials.	Apply	PO2, PO3, PO4
CO3	**Deduce** the Microsystems technology for technical feasibility.	Analyze	PO3, PO4, PO6, PO8
CO4	Able to **Design** MEMS based micro systems and micro devices.	Design	PO5, PO6, PO8, PO9, PO12

Unit-I:

Overview of MEMS: MEMS and Microsystems definitions and examples, Difference between Microsystems and Microelectronics, Benefits of miniaturization, Applications: Industrial/automotives sensors, Medical systems, aircraft sensors, Structural health monitoring, Telecommunication etc, Materials for MEMS.

Outcome: Interpret the role of miniaturization of MEMS based microelectronic devices and systems in various fields.

Activity/Event: Closely observe the MEMS applications by going through the literature

Unit-II:

Scaling Laws in Miniaturization: Introduction to Scaling, Scaling in Geometry, Scaling in Electrostatic forces. MEMS Design Considerations.

Outcome: Realize the role of Scaling laws in MEMS designing.

Activity/Event: Conduct some seminar classes

Unit-III:

Micro Fabrication –I: Introduction, Photolithography, Photo resists and Application, Light Sources, Photo resist Removal, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition (CVD),
Sputtering, Deposition by Epitaxy, Etching.

Outcome: Get exposure to various fabrication techniques of microelectronics devices

Activity/Event: Case study

Unit-IV:

Micro Fabrication – II

Bulk Micromachining: Etching-Isotropic and Anisotropic, Wet Etching and Dry Etching (Plasma, Deep reactive ion) Comparison Surface
Micromachining: Process, associated Mechanical problems (Adhesion, Interfacial stresses, Stiction), LIGA process, MEMS Packaging.
Outcome: Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.

Activity/Event: Case study

Unit-V:

MEMS Devices and Structures: Micro sensors: Biomedical Sensors, Chemical sensors, Optical Sensors, Pressure Sensors, Thermal Sensors.

Micro actuation: Actuation using thermal forces, Piezoelectric crystals, Electrostatic forces, MEMS with micro actuators: Micro grippers, Micro motors, Micro gears, Micro pumps.

Outcome: Able to design the micro devices, micro systems using the MEMS fabrication process.

Activity/Event: Hands-on session to design MEMS based devices.

Text Books:

1. "MEMS & Microsystems Design and Manufacture", Tai-Ran Hsu, Tata McGraw Hill.
2. "Microsystem Design", Stephen D Senturia, Springer Publication, 2000.

Reference Books:

1. "Fundamentals of Micro Fabrication.", Marc Madou , 3rdEdition, CRC Press
2. "Foundations of MEMS", Chang Liu, Pearson Education Inc., 2012
3. "The MEMS Handbook" , Mohamed Gad-el-Hak , CRC Press

Course Code	OPERATING SYSTEMS (Elective-II)	L	T	P	Credits
1005172206		3	1	0	3

Course Overview:

This course will introduce the core concepts of operating systems, such as processes and threads, scheduling, synchronization, memory management, file systems, input and output device management and security.

Course Objectives:

- Study the basic concepts and functions of operating systems.
- Understand the structure and functions of OS.
- Learn about Processes, Threads and Scheduling algorithms.
- Understand the principles of concurrency and Deadlocks.
- Learn various memory management schemes.
- Study I/O management and File systems.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Summarize the mechanism of OS to handle process and threads and their communication	Understand	PO-1, PO-2, PO-12
CO2	Demonstrate OS architecture, mutual exclusion algorithms, deadlock detection algorithms.	Apply	PO-1, PO-2, PO-3
CO3	Describe the components and aspects of concurrency management	Analyze	PO-1, PO-2, PO-3, PO-4, PO-10
CO4	Examine the mechanism involved in memory management in contemporary OS.	Evaluate	PO-1, PO-2, PO-3, PO-4, PO-10

Unit-I:
Introduction to Operating System Concept: Types of operating systems, operating systems concepts, operating systems services, Introduction to System call, System call types.

Outcome: Define Operating System and describe types of Operating Systems.

Activity: Brainstorming method.

Unit-II:
Process Management – Process concept, the process, Process State Diagram, Process control block, Process Scheduling- Scheduling Queues, Schedulers, Operations on Processes, Inter process Communication, Threading Issues, Scheduling-Basic Concepts, Scheduling Criteria,

Scheduling Algorithms. Case Studies: UNIX, Linux, Windows

Outcome: Define the concept of process and apply process scheduling algorithms.

Activity: Problem solving related to CPU Scheduling algorithms.

Unit-III:

Memory Management:
Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation Case Studies: UNIX, Linux, Windows

Virtual Memory Management:
Virtual Memory, Demand Paging, Page-Replacement Algorithms, Thrashing

Outcome: Illustrate the concept of Paging and Segmentation.

Activity: Visualization of concepts using model charts.

Unit-IV:

Concurrency:
Process Synchronization, The Critical- Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples Case Studies: UNIX, Linux, Windows

Principles of deadlock:
System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock

Outcome: Apply the concept of Concurrency to real world problems

Activity: Role play related to classic problems of synchronization
Unit-V:

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 scheduling, Device drivers, Case Studies: UNIX, Linux, Windows

Outcome: Design and Implement a prototype file system

Activity: Seminar method

Text Books:

1. Edition Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne9th Edition, John Wiley and Sons Inc., 2012.
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition,

Prentice Hall, 2011.
3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second 2016.

Reference Books:

1. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley,2001.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata Mc Graw Hill Education", 1996.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhere, Second Edition, TataMc Graw-Hill Education, 2007.

Course Code	MICROWAVE ENGINEERING & OPTICAL COMMUNICATION LAB	L	T	P	Credits
1004174121		0	0	3	2

Minimum Ten Experiments to be conducted:

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. Impedance and Frequency Measurement.
6. Scattering parameters of Circulator.
7. Scattering parameters of Magic Tee.
8. Radiation Pattern of Horn and Parabolic Antennas.
9. Synthesis of Microstrip antennas (Rectangular Structure) Using HFSS.
10. Characterization of LED.
11. Characterization of Laser Diode.
12. Intensity modulation of Laser output through an optical fiber.
13. Measurement of Data rate for Digital Optical link.
14. Measurement of NA.
15. Measurement of losses for Analog Optical link.

Equipment required for Laboratories:

1. Regulated Klystron Power Supply, Klystron mount
2. VSWR Meter
3. Micro Ammeter
4. Multi meter
5. CRO
6. GUNN Power Supply, Pin Modulator
7. Crystal Diode detector
8. Micro wave components (Attenuation)
9. Frequency Meter
10. Slotted line carriage
11. Probe detector
12. Wave guide shorts
13. SS Tuner
14. Directional Coupler
15. E, H, Magic Tees
16. Circulators, Isolator
17. Matched Loads
18. Pyramidal Horn and Parabolic Antennas
19. Turntable for Antenna Measurements
20. HFSS Software
21. Fiber Optic Analog Trainer based LED
22. Fiber Optic Analog Trainer based laser
23. Fiber Optic Digital Trainer
24. Fiber cables – (Plastic, Glass)

Course Code	DIGITAL IMAGE PROCESSING LAB	L	T	P	Credits
1004174122		0	0	3	2

List of the Experiments / programs

1. Outline the image processing concepts for matlab image tool bar.
2. Analyze the digital image processing and identify the pixels, gray levels by using image formats in both gray and colours.
3. Generate programs for image transforms (Walsh/haar/slant/hadamard/DCT)
4. Calculate the histogram equalization for real time images.
5. Collect the different types of images and apply image smoothing filters/averaging filters/spatial filters.
6. Design image restoration technique in frequency domain (Wiener filter)
7. Generate programs for edge detection techniques. (Sobel/Prewitt/Canny/Robust)
8. Calculate the Lossless Compression and lossy compressionusing image formats.
9. Construct morphological operations for erosion,dilation, opening and closing for an image.
10. Calculate the histogram equalization, image segmentation for real time colour images.

Equipments & Software required:

1. Computer Systems with latest specifications.
2. Connected in Lan (Optional).
3. Operating system (Windows XP).
4. Simulations software (MATLAB)

Course Code	INTELLECTUAL PROPERTY RIGHTS AND PATENTS	L	T	P	Credits
1099173101		2	0	0	0

Course Overview:

This Course provides the students with a wide perspective and in depth knowledge in intellectual property to enable them to get solid grounding in the legislative framework, practice and procedure of the intellectual property protected through patents, trademarks, copyrights, designs and geographical indications.

Course Objectives:

- To know the importance of Intellectual property rights, which plays a vital role in advanced Technical and Scientific disciplines.
- Imparting IPR protections and regulations for further advancement, so that the students can familiarize with the latest developments.

Course Outcomes:

	COURSE OUTCOME	Bloom's cognitive level	PO
CO-1	The students once they complete their academic projects, they get awareness of acquiring the patent and copyright for their innovative works. They also get the knowledge of plagiarism in their innovations which can be questioned legally.	Remembering, Understanding, Applying	PO8, PO11, PO12

Unit-I:

Introduction to Intellectual Property Rights (IPR)-Concept of Property - Introduction to IPR – International Instruments and IPR - WIPO - TRIPS – WTO -Laws Relating to IPR - IPR Tool Kit - Protection and Regulation - Copyrights and Neighboring Rights – Industrial Property – Patents - Agencies for IPR Registration – Traditional Knowledge –Emerging Areas of IPR - Layout Designs and Integrated Circuits – Use and Misuse of Intellectual Property Rights.

Unit-II:

Copyrights and Neighboring Rights-Introduction to Copyrights – Principles of Copyright Protection – Law Relating to Copyrights - Subject Matters of Copyright – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of Performers **–** Copyright Registration – Limitations – Infringement of Copyright – Relief and Remedy – Case Law - Semiconductor Chip Protection Act

Unit-III:

Patents

Introduction to Patents - Laws Relating to Patents in India – Patent Requirements – Product Patent and Process Patent - Patent Search - Patent Registration and Granting of Patent - Exclusive Rights – Limitations - Ownership and Transfer — Revocation of Patent – Patent Appellate Board - Infringement of Patent – Compulsory Licensing — Patent Cooperation Treaty – New developments in Patents – Software Protection and Computer related Innovations.

Trademarks

Introduction to Trademarks – Laws Relating to Trademarks – Functions of Trademark – Distinction between Trademark and Property Mark – Marks Covered under Trademark Law - Trade Mark Registration – Trade Mark Maintenance – Transfer of rights - Deceptive Similarities - Likelihood of Confusion - Dilution of Ownership – Trademarks Claims and Infringement – Remedies – Passing Off Action.

Unit-IV:
Trade Secrets

Introduction to Trade Secrets – General Principles - Laws Relating to Trade Secrets - Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee - Confidentiality Agreements – Breach of Contract –Law of Unfair Competition – Trade Secret Litigation – Applying State Law.

Unit-V:
Cyber Law and Cyber Crime

Introduction to Cyber Law – Information Technology Act 2000 - Protection of Online and Computer Transactions - E-commerce - Data Security – Authentication and Confidentiality - Privacy - Digital Signatures – Certifying Authorities - Cyber Crimes - Prevention and Punishment – Liability of Network Providers.
Relevant Cases Shall be dealt where ever necessary.

Reference Books:

1. Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxford University Press, New Delhi.
2. Deborah E.Bouchoux: Intellectual Property, Cengage Learning, New Delhi.
3. PrabhuddhaGanguli: Intellectual Property Rights, Tata Mc-Graw –Hill, New Delhi
4. Richard Stim: Intellectual Property, Cengage Learning, New Delhi.
5. Kompal Bansal &Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications (Press).
6. Cyber Law - Texts & Cases, South-Western's Special Topics Collections
7. R.Radha Krishnan, S.Balasubramanian: Intellectual Property Rights, Excel Books. New Delhi.
8. M.Ashok Kumar and MohdIqbal Ali: Intellectual Property Rights, Serials Pub.

DETAILED SYLLABUS

FOR

IV B. TECH

II SEMESTER

Course Code	SATELLITE COMMUNICATIONS	L	T	P	Credits
1004174201		3	1	0	3

Course Overview: This course will introduce students to this rapidly growing field and equip them with some of its basic principles and applications. Students will learn concepts of Frequency allocations, Applications, and Future Trends of Satellite Communications, the G/T ratio, Design of down links, up link design, Tracking systems, Terrestrial interface, Delay & Throughput considerations, System considerations, operational NGSO constellation Designs, and CDMA, TDMA, FDMA.

Course Objectives:

- Summarize Frequency allocations, Applications, and Future Trends of Satellite Communications.
- Enlighten the concepts of telemetry, tracking, Command and monitoring, communication subsystems
- Explain the G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N,
- Analyse concepts of Tracking systems, Terrestrial interface, Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, operational NGSO and compare multiple access techniques.

Course Outcomes:

After completion of the course students able to:

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Explain the concepts, Basic Concepts, Frequency allocations, Applications, and Future Trends of Satellite Communications. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Understand Apply	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO2	Apply Concepts to Attitude and orbit control, telemetry, tracking, Command and monitoring, communication subsystems. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Apply Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO3	Analyse Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example. **Submit Review report On Satellite Link Design (Uplink/Downlink, C/N**	Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12

	design) from Research journals with professional ethics, team work and self-learning.		
CO4	Analyse concepts of Tracking systems, Terrestrial interface, Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, operational NGSO constellation Designs, and CDMA, TDMA, FDMA. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12

Unit-I:

INTRODUCTION: Historical Back-ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

ORBITAL MECHANICS AND LAUNCHERS: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.

Outcome: Explain the concepts, Applications, and Future Trends of Satellite Communications

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning

Unit-II:

SATELLITE SUBSYSTEMS: Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space qualification.

Outcome: Apply Concepts to Attitude and orbit control, TTC and communication subsystems.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning

Unit-III:

SATELLITE LINK DESIGN: Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example.

Case study from Journals like IEEE, Elsevier: On Satellite Link Design (Uplink/Downlink, C/N design)

Outcome Analyse Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N.
Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

Unit-IV:

MULTIPLE ACCESS: Frequency division multiple access (FDMA) Inter modulation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples. Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple access (CDMA), Spread spectrum transmission and reception.
Case study from Journals like IEEE, Elsevier: On TDMA, DAMA, CDMA.
Outcome: Analyse concepts of Multiple access techniques CDMA, TDMA, FDMA.
Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

Unit-V:

EARTH STATION TECHNOLOGY: Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods.

LOW EARTH ORBIT AND GEO-STATIONARY SATELLITE SYSTEMS: Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, Operational NGSO constellation Designs.

Outcome: Analyse concepts of Tracking systems, Terrestrial interface, Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, operational NGSO constellation Designs, and CDMA, TDMA, and FDMA.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

Text Books:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications, 2003.

Reference Books:

1. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed.
2. Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004

Course Code		L	T	P	Credits
1004174202	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	3	1	0	3

Course Overview:

This course will help to develop skills to measure electrical parameters using various instruments. By learning this course students will able to know basics of various Instruments, transducers and working of electronic circuits used in electronic test and measuring instruments.

Course Objective:

To introduce the performance characteristics of instruments and how different types of meters work and their construction, Understand the Functions of signal generators, Wave Analyzers and Oscilloscopes, Principle of operation of Bridges and Various types of Transducers and their operations.

Course Outcomes:

After completion of the course students able to

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	**Understand** the performance characteristics of instruments then **Choose** the instrument to be used based on the requirements.	Understanding Applying	PO-1 PO-2 PO-12
CO2	**Understand** the functions of Oscilloscopes, signal generators, analyzers and **Calculate amplitude**, frequency and phase of the signals	Understanding Applying	PO-1 PO-2
CO3	**Understand** the Balancing conditions of the bridges to **Calculate** the unknown values of Resistor, Capacitor and Inductor.	Understanding Applying	PO-1 PO-2
CO4	**Understand** the performance of different transducers to **Measure** different parameters such as velocity, humidity, speed, proximity.	Understanding Evaluating	PO-1 PO-2 PO-8

UNIT- I

Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error. DC Voltmeters- Multi-range, Range extension, AC voltmeters- multi range, range extension, shunt. Thermocouple type RF ammeter, Ohmmeters series type, and shunt type, Multimeter.

Outcome: Student will be able to understand the performance characteristics of instruments and select the instrument to be used based on the requirements.

Activity/event: Measure various electrical parameters: voltage, current and resistance values with accuracy, precision, resolution using multimeter.

Unit-II:

Signal Generator- fixed and variable, AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Square pulse, sweep, Arbitrary waveform. Wave Analyzers, Harmonic Distortion Analysers, Spectrum Analysers.

Outcome: Student will be able to Generate and analyze the characteristics of different signals with signal generators and analyzers.

Activity/event: Generate different types of signals using function generator and analyze their spectrums with analyzers.

Unit-III:

Oscilloscopes CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, simple CRO, triggered sweep CRO, Dual beam CRO, Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital storage oscilloscope, probes for CRO- Active & Passive.

Outcome: Student will be able to calculate amplitude, frequency, phase of the signals with the Oscilloscope.

Activity/event: Calculate the frequency of various signals with the help of Lissajous method.

Unit-IV:

AC Bridges Measurement of inductance- Maxwell's bridge, Anderson Bridge. Measurement of capacitance - Schering Bridge. Wheat stone bridge. Wien Bridge, Q-meter.

Outcome: Student will be able to Balance the bridge conditions to find unknown values of resistor, capacitor and inductor.

Activity/event: Calculate the unknown values of resistor, capacitor and Inductor under balanced condition of suitable bridges with reference value.

Unit-V:

Transducers- active & passive transducers: Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Thermistors, Measurement of physical parameters: velocity, humidity, speed, proximity, Data Acquisition Systems.

Outcome: Student will be able to understand the operation different transducers for measurement of different parameters.

Activity/event: Measure different parameters using suitable transducers.

Text Books:

1. "Electronic instrumentation", second edition - H.S.Kalsi, Tata McGraw Hill, 2004.
2. "Modern Electronic Instrumentation and Measurement Techniques" – A.D. Helfrick and W.D. Cooper, PHI, 5thEdition, 2002.

Reference Books:

1. "Electronic Instrumentation & Measurements" - David A. Bell, PHI, 2nd Edition, 2003.
2. "Electronic Test Instruments, Analog and Digital Measurements" - Robert A.Witte, Pearson Education, 2nd Ed.,2004.
3. "Electronic Measurements & Instrumentations", K. Lal Kishore, Pearson Education, 2005

Course Code		L	T	P	Credits
1004174203	**RADAR SYSTEMS**	3	1	0	3

Course Overview:

This course covers the fundamentals concepts needed to understand the design and operation of radar systems for a variety of applications. Topics covered include the radar range equation, signal to noise ratio, radar cross section, range, velocity ambiguity, radar clutter, detection, design of transmitter and receiver. Applications surveyed include pulsed CW and FM radars, Doppler radars.

Course Objective:

The student will be introduced to:

1. The Basic Principle of radar and radar range equation.
2. Different types of radars; CW, FM-CW, MTI and pulse Doppler radars.
3. Understand the different tracking techniques for radar.
4. Understand the characteristics of a matched filter receiver and its performance.
5. Understand the different types of displays, duplexers and antennas used in radar systems.

Course Outcomes:

After completion of the course students able to learn:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Demonstrate the factors affecting the radar performance using Radar Range Equation.	Understand	PO-1, PO-2, PO-12
CO2	Illustrating the principle of FMCW radar in the design of altimeter.	Apply	PO-1, PO-2, PO-3
CO3	Differentiate between MTI radars and pulse Doppler radar.	Analyze	PO-1, PO-2, PO-3, PO-4, PO-10
CO4	Demonstrate the importance of matched filter receiver in radar systems	Evaluate	PO-1, PO-2, PO-3, PO-4, PO-10

Unit-I:

Basics of Radar: Introduction, Maximum Unambiguous Range, simple Radar range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Illustrative Problems. Radar Equation: Modified Radar Range Equation, SNR, probability of detection, probability of False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Creeping Wave, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems

Outcome: Demonstrate the factors affecting the radar performance using Radar Range Equation.

Activity/Event: Design of radar system to evaluate performance using MATLAB.

Unit-II:

CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar. Illustrative Problems FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter, Multiple Frequency CW Radar.

Outcome: Illustrating the principle of FMCW radar in the design of altimeter.

Activity/Event: Design of FMCW altimeter in MATLAB.

Unit-III:

MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Nth Cancellation Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

Outcome: Differentiate between MTI radars and pulse Doppler radar.

Activity/Event: Design of delay line canceller using MATLAB.

Unit-IV:

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers. Radomes

Outcome: Different tracking, MTI & Radar

Activity/Event: Visit to radar station, Visakhapatnam.

Unit-V:

Detection of Radar Signals in Noise: Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise, Noise Figure and Noise Temperature. Radar Receivers –Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers.

Outcome: Demonstrate the importance of matched filter receiver in radar systems.

Activity/Event: Calculate duplexer parameters in microwave lab.

Text Books:

1. "Introduction to Radar Systems" – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Ed., 2007.
2. "Principles of Modern Radar": Basic Principles – Mark A. Richards, James A. Scheer, William A. Holm, Yesdee

Reference Books:

1. "Introduction to Radar Systems", 3rd edition – M.I. Skolnik, TMH Ed., 2005
2. "Radar: Principles", Technology, Applications – Byron Edde, Pearson Education, 2004.
3. "Radar Principles" – Peebles, Jr., P.Z., Wiley, New York, 1998.
4. "Radar Engineering" – GSN Raju, IK International.

Course Code	DATA SCIENCE (Elective-III)	L	T	P	Credits
1004174204		3	1	0	3

Course Overview: Data Science is the study of the generalizable extraction of knowledge from data. Being a data scientist requires an integrated skill set spanning mathematics, statistics, machine learning, databases and other branches of computer science along with a good understanding of the craft of problem formulation to engineer effective solutions. This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset. Students will learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration, exploratory data analysis, descriptive modelling, data product creation, evaluation, and effective communication. The focus in the treatment of these topics will be on breadth, rather than depth, and emphasis will be placed on integration and synthesis of concepts and their application to solving problems.

Course Objectives:

- Demonstrate by applying the basic tools (plots, graphs, summary statistics) to carry out EDA and the data science process in a case study.
- Explain why Linear Regression and k-NN are poor choices for Filtering Spam than better Naive Bayes.
- Enlighten work effectively in teams of data science projects and apply ethical practices conduct in data science.
- Identify probability distributions for statistical modelling and Fit a model to data.

Course Outcomes: After completion of the course students able to:

	Course Outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Explain the significance of exploratory data analysis (EDA) in data science and Apply plots, graphs, summary statistics to carry out EDA and the data science process in a case study. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Understand Apply	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO2	Apply machine learning algorithms for predictive modelling and Explain why Linear Regression and k-NN are poor choices for Filtering Spam than better Naive Bayes. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Apply Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12

CO3	Analyse algorithmic ingredients that constitute a Recommendation Engine, build their own recommendation system using existing components. Create effective visualization of data and Work effectively in data science projects with ethical practices in data science. **Submit Review report on this.**	Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO4	Analyse concepts of Data Science, the skill sets needed to be a data scientist and Identify probability distributions for statistical modelling and Fit a model to data. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12

UNIT-I

Introduction: What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed

Statistical Inference: Populations and samples - Statistical modelling, probability distributions, fitting a model - Intro to R.

Outcome:

Explain the concepts of Statistical modelling, probability distributions, fitting a model

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning

UNIT-II

Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: Real Direct (online real estate firm)

Three Basic Machine Learning Algorithms: Linear Regression, - k-Nearest Neighbours (k-NN),- k-means.

Outcome: Analyze Linear Regression, - k-Nearest Neighbours (k-NN),- k-means.

Activity/Event: Case study: Submit Review report on Real Direct (online real estate firm) with professional ethics, team work and self-learning

UNIT-III

One More Machine Learning Algorithm and Usage in Applications: Motivating application: Filtering Spam, - Why Linear Regression and k-NN are poor choices for Filtering Spam, - Naive Bayes and why it works for Filtering Spam, - Data Wrangling: APIs and other tools for scrapping the Web

Feature Generation and Feature Selection (Extracting Meaning From Data): Motivating application: user (customer) retention, - Feature Generation (brainstorming, role of domain expertise, and place for imagination), - Feature Selection algorithms, Filters, Wrappers, Decision Trees, Random Forests

Outcome: Compare Feature Selection algorithms

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

UNIT-IV

Recommendation Systems Building a User-Facing Data Product: Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system.

Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighbourhood properties in graphs.

Outcome: Analyse discovery of communities in graphs, Partitioning of graphs, Neighbourhood properties in graphs.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

UNIT-V

Data Visualization: Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects, Exercise: create your own visualization of a complex dataset

Data Science and Ethical Issues: Discussions on privacy, security, ethics: A look back at Data Science, Next-generation data scientists

Case Study: Philosophy, Ethics, and Safety of Data Science

Outcome: Analyse and create examples of inspiring (industry) projects

Activity/Event: Case study: Submit Review report of Philosophy, Ethics, and Safety of Data Science from Research journals with professional ethics, team work and self-learning.

Text Books: The following books will be used as a textbook and primary resource to guide the discussions, but will be heavily supplemented with lecture notes and reading assignments from other sources.

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.
2. Jure Leskovek, Anand Rajaraman and Je rey Ullman. Mining of Massive Datasets. Cambridge University Press. 2014. (free online)

Reference Books:

1. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
2. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)
3. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

Course Code	LOW POWER VLSI DESIGN (Elective-III)	L	T	P	Credits
1004174205		3	1	0	3

Course Overview:

This course Provides in depth knowledge to design VLSI circuits with low power consumption and efficient architectures.

Course Objectives:

The course objectives are:

- The student will be able to understand the Fundamentals of Low Power VLSI Design.
- In this course, students can study low-Power Design Approaches, Power estimation and analysis.
- Another main object of this course is to motivate the graduate students to study and to analyze the Low-Voltage Low-Power Adders, Multipliers.
- The concepts of Low-Voltage Low-Power Memories and Future Trend and Development of DRAM.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Understand the necessity for low Power design and various effects of power dissipation in VLSI circuit design	Understand	PO1
CO2	Learn different approaches to design a low power circuit	Understand/ Analyze	PO1, PO2
CO3	Understand and analyze low power adders and multiplier architectures and extend them to different applications.	Understand/ Analyze/ Design	PO1, PO2, PO3, PO4, PO5
CO4	Understand low power and low voltage memories and basics of RAM.	Understand/Analyze/ Design	PO1, PO2, PO3, PO4, PO5,

Unit-I:

Fundamentals of Low Power VLSI Design: Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

Outcome: Understand the necessity for low Power design and various effects of power dissipation in VLSI circuit design.

Activity/Event: To obtain Power Dissipation for the given CMOS circuit

Unit-II:

Low-Power Design Approaches: Low-Power Design through Voltage Scaling: VTCMOS circuits, MTCMOS circuits, Architectural Level Approach–Pipelining and Parallel processing Approaches.

Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures.

Outcome: Learn different approaches to design a low power circuit
Activity/Event: design of CMOS circuit using low power design approaches

Unit-III:

Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low-Power Design Techniques –Trends of Technology and Power Supply Voltage, Low- Voltage Low-Power Logic Styles.
Outcome: Understand and analyze low power adders architectures and extend them to different applications.
Activity/Event: Design of CMOS circuit using low power adder architecture

Unit-IV:

Low-Voltage Low-Power Multipliers: Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh- Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

Outcome: Understand and analyze low power multiplier architectures and extend them to different applications.
Activity/Event: D**esign of** CMOS **circuit using low power adder architecture**

Unit-V:

Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.
Outcome: Understand low power and low voltage memories and basics of RAM.
Activity/Event: Design of CMOS circuit using low power memory architecture

Text Books:

1. "Low-Voltage, Low-Power VLSI Subsystems" – Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering.

Reference Books:

1. "Low Power CMOS VLSI Circuit Design" – Kaushik Roy, Sharat C. Prasad, John Wiley & Sons, 2000.
2. "Practical Low Power Digital VLSI Design" – Gary K. Yeap, Kluwer Academic Press, 2002.

Course Code	WIRELESS COMMUNICATION AND NETWORKING (Elective-III)	L	T	P	Credits
1004174206		3	1	0	3

Course Overview: This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset. Students will learn concepts to solve wireless communications problems. Identify existing model's, Apply cellular system design concepts, performance analysis of wireless wide area networks. Apply the concepts to orthogonal frequency division multiplexing. They are able to Submit Review report from Research journals with professional ethics, team work and self-learning.

Course Objectives: Students will understand the

- Applications of frequency reuse, and concepts to solve wireless communications problems.
- Existing model's, Apply cellular system design concepts, wireless wide area networks for their performance analysis.
- Analysis of multiple access schemes used in wireless communications and existing and emerging wireless standards.
- Wireless local area networks and their specifications.

Course Outcomes:

After completion of the course students able to:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	**Apply** communication concepts to solve wireless communications problems. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Apply	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO2	Identify existing model's, Apply cellular system design concepts, wireless wide area networks for their performance analysis. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Apply Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12
CO3	Analyse various multiple access schemes used in wireless communications and existing and emerging wireless standards. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12

CO4	Demonstrate wireless local area networks and their specifications. Apply the concepts to orthogonal frequency division multiplexing. **Submit Review report from Research journals with professional ethics, team work and self-learning.**	Understand Apply Analyse	PO-1, PO-2, PO-8, PO-9, PO-10, PO-12

UNIT - I

The Cellular Concept-System Design Fundamental: Introduction, Channel Assignment Strategies, Interference and system capacity – Co channel Interference and system capacity, Adjacent Channel interference, Power Control for Reducing interference, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring.

Outcome: Explain the quality of wireless communication systems with consideration of spectrum efficiency.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning

UNIT – II

Mobile Radio Propagation: Large-Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, The Three Basic Propagation Mechanisms, Reflection-Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two Ray) Model.

Outcome: Apply Concepts to wireless communication for mobile radio propagation.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning

UNIT – III

Mobile Radio Propagation: **Small–Scale Fading and Multipath:** Small Scale Multipath Propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel- Relationship between Bandwidth and Received power, Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading.

Outcome: Analyse Doppler shift and spread, mobile multipath channel parameters.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

UNIT - IV

Equalization and Diversity: Introduction, Fundamentals of Equalization, Training a generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Nonlinear Equalization Least Mean Square Algorithm, Recursive least squares algorithm. Diversity Technique-RAKE Receiver.

Outcome: Demonstrate the use of diversity techniques and nonlinear equalisation LMS algorithm.

Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

UNIT - V

Wireless Networking: Introduction to wireless Networks, wireless data services, common channel signaling, signaling system no.7;

Wireless systems: Global System for Mobile: GSM services, GSM architecture, radio subsystem, GSM channel types, frame structure of GSM.

Outcome: Analyse GSM wireless system services, architecture, and wireless networking.
Activity/Event: Case study: Submit Review report from Research journals with professional ethics, team work and self-learning.

TEXT BOOKS:

1. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed., 2002, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.

REFERENCE BOOKS:

1. Wireless Communication and Networking – William Stallings, 2003, PHI.
2. Principles of Wireless Networks – Kaveh Pahlaven and P. Krishna Murthy, 2002, Pearson Education.

Course Code	PATTERN RECOGNITION (Elective-III)	L	T	P	Credits
1004174207		3	1	0	3

Course Overview:

Basic on pattern recognition - Design cycle of pattern recognition- Statistical Patten Recognition- Nonparametric Techniques-Maximum likelihood and Bayesian Parameter Estimation -Pattern Recognition in Image Processing.

Course Objectives:

- To introduce fundamentals of pattern recognition.
- To expose various statistical pattern recognition and normal density
- To impart concepts various nonparametric techniques for pattern recognition.
- To dissimilate various hidden markov models for pattern recognition.
- To introduce the concepts of image processing in pattern recognition.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Apply the mathematical foundations for recognition of patterns	Analyze	PO2, PO4, PO5
CO2	Develop the principles of statistical pattern recognition and apply non parametric techniques in pattern recognition in real time applications	Analyze	PO2, PO4, PO5
CO3	Demonstrate maximum likelihood and Bayesian parameter estimation for hidden Markov models.	Apply	PO2
CO4	Justify real time applications in image pattern recognition.	Analyze	PO2, PO4, PO5

Unit-I:

Introduction: Introduction to pattern recognition – Design cycle of pattern recognition system, Learning and adaptation.

Outcome:

- Explain mathematical models of various types of pattern recognition
- Define Pattern recognition approaches such as learning and adaptation.

Activity/Event: Seminar

Unit-II:

Bayesian Decision Theory: Continuous features, Minimum error rate classification, Normal Density, Bayes Decision Theory-Discrete Features.

Outcome:

- Compare statistical pattern recognition in Bayesian theory
- Apply Bayesian Decision Theory techniques for Normal density and discriminate functions.

Activity/Event: Executing programs using MATLAB software.

Unit-III:

Maximum likelihood and Bayesian Parameter Estimation: Maximum Likelihood Estimation, Bayesian Estimation, Hidden Markov models: First-Order Markov Models, First-Order Hidden Markov Models, Hidden Markov Model Computation.

Outcome:

- Describe various Bayesian parameter estimation for pattern recognition.
- Apply various hidden Markov models techniques in real time applications.

Activity/Event: Executing programs using MATLAB software.

Unit-IV:

Nonparametric Techniques: Density Estimation, K-Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification.

Outcome:

- Describe various nonparametric techniques.
- Illustrate detection of nearest neighbour rule in fuzzy classification.

Activity/Event: Executing programs using MATLAB software.

Unit-V:

Pattern Recognition: The Unsupervised Clustering Algorithm, Support Vector Machine, Neural Networks, Fuzzy Sets in Image Analysis

Outcome:

- Describe various Unsupervised Clustering Algorithm for pattern recognition
- Apply various techniques for fuzzy sets in image analysis and image processing applications

Activity/Event: Executing programs using MATLAB software.

Text Books:

1. "Pattern Classification", Richard O. Duda, Peter E. Hart and David G. Stork, 2nd edition, John Wiley, 2006.
2. Shih, Frank Y. Image processing and pattern recognition: fundamentals and techniques. John Wiley & Sons, 2010.

Reference Books:

1. "Pattern Recognition", S. Theodoridis, K. Koutroumbas, 4th Edition, Academic Press, 2009.
2. Theodoridis, Sergios, AggelosPikrakis, Konstantinos Koutroumbas, and DionisisCavouras. Introduction to pattern recognition: a matlab approach. Academic Press, 2010.