ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

ELECTRONICS & COMMUNICATION ENGINEERING

FOR
B.TECH FOUR YEAR DEGREE COURSE
(Applicable for the batches admitted from 2016-17)

Learning is Supreme Diety

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)

Permanently Affiliated to JNTUK, Kakinada and Approved by AICTE, New Delhi
Accredited by NAAC with "A" Grade
Recognized by UGC 2(f) and 12(b) under UGC act, 1956
1-378, ADB Road, Surampalem- 533437, near Peddapuram
E.G.District, Andhra Pradesh.

Institute Vision and Mission

Vision

To emerge as a Premier Institution for Technical Education in the Country through Academic Excellence and to be recognized as a Centre for Excellence in Research & Development, catering to the needs of our Country.

Mission

To realize a strong Institution by consistently maintaining State – of – Art – infrastructure, build a cohesive, World Class Team and provide need based Technical Education, Research and Development through enhanced Industry Interaction

Vision and Mission of the Department

Vision

To be an acknowledged Leader in providing quality education, training and research in area of Electronics and Communication Engineering to meet the industrial and Societal needs.

Mission

- **M1:** To facilitate students with a state-of-the-art infrastructure, learning environment and value-based education to improve technical knowledge and skills for continuous learning process.
- **M2:** To impart high quality education with well qualified faculty and enable students to meet the challenges of the industry at global level
- **M3:** To promote innovation and active industry institute interaction by facilitating the students to improve their leadership and entrepreneurship skills with ethical values.

POs	Program Outcomes
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design / Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
PSOs	**Program Specific Outcomes**
PSO1	Ability to apply concepts in electronics and communication engineering, to design and implement complex systems in the areas related to analog and digital electronics , communication, signal processing ,VLSI& ES
PSO2	Ability to provide discerning solutions based on their expertise in electronics and communication courses in competitive examinations for successful employment, higher studies and research.

ACADEMIC REGULATIONS FOR B.TECH (REGULAR)

Applicable for the students of B.Tech (Regular) Admitted from the academic year 2016-2017.

1. AWARD OF B.TECH DEGREE

A Student will be declared eligible for the award of B.Tech Degree if he fulfills the following academic regulations.

1.1 A Student shall be declared eligible for the award of the B.Tech Degree, if he pursues a course of study for not less than four and for not more than eight academic years.

1.2 The candidate shall register for 180 credits and secure all the 180 credits.

2. COURSES OF STUDY

The following courses of study are offered at present as specializations for the B.Tech course with English as medium of instruction.

S. No.	***Branch / Course***
01.	Civil Engineering (CE)
02.	Electrical and Electronics Engineering (EEE)
03.	Mechanical Engineering (ME)
04.	Electronics and Communications Engineering (ECE)
05.	Computer Science and Engineering (CSE)
06.	Information Technology (IT)

3. MINIMUM INSTRUCTIONS DAYS.

The minimum instruction days for each semester shall be 90 working days

4. PROGRAMME/ COURSE CREDITS

4.1. Each discipline / course of the four year B.Tech programme is designed to have a total of 180 credits**.** Depending upon the nature of each subject and the number of periods of instruction whether it is theory, laboratory, drawing etc., weightages are given in terms of number of credits. See course structure for details.

5. **ATTENDANCE REQUIREMENTS :**

5.1. A student is eligible to appear for the End semester examinations only if he puts in a minimum of 75% of attendance in aggregate of all the subjects.

5.2. Condonation of shortage of attendance in the aggregate upto 10% (65% and above and below 75%) in each semester may be granted by a committee appointed for this purpose, after getting satisfied that the absence is due to genuine reasons.

5.3. Shortage of attendance below 65% in aggregate shall not be condoned.

5.4. A student who has shortage of attendance in a semester may seek readmission in to the course when offered next.

5.5. A fee stipulated by the college shall be paid along with the application for the condonation of shortage of attendance.

5.6. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations and the registration shall stand cancelled.

6. **DISTRIBUTION AND WEIGHTAGE OF MARKS**

The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks. 40 marks for internal evaluation and 60 marks for the end examination have been earmarked. The Project Work shall be evaluated for 200 marks. The mini project/Term Paper/Seminar has a weightage of 50 marks and evaluated internally.

Depending upon the nature of the subject, the distribution and weightages for internal and external assessment are as detailed below:

6.1. Theory Subjects

i. Internal assessment : 40 marks

a) For the Mid examinations there shall be two tests, one conducted in the middle and the other at the end of each semester. The duration of each test is two hours. The question paper contains **Part-A** and **Part-B**. Part-A consists of three questions. Out of three questions two questions carry seven marks and one question carry six marks. Part-B consists of twenty objective type questions each carry half mark. Answering all questions is compulsory.

b) Students shall submit assignments at the end of each unit in the syllabus and the marks allotted for the assignments is 10.

c) The formula for finding the total marks of internal assessment (40 marks) = 0.80 x higher marks scored between the two internal tests + 0.20 x marks scored in the other test + marks for the assignments.

ii. External assessment :

a) The end semester examination is of 3 hours duration and contains **Part A** and **Part B**. It covers all the topics in all the 6 units and the weightage is 60 marks.

b) Part A consists of 6 short questions each carrying 2 marks (6 x 2 = 12 marks). These 6 questions are compulsory and cover all the 6 units in the syllabus.

c) Part B consists of 6 essay type / numerical questions, One question is set from each unit in the syllabus. Some questions may have sub sections. The student has to answer 4 out of 6 questions, each question with a weightage of 12 marks (4 x 12) = 48 marks.

6.2. Laboratory Courses

i. Internal assessment : 40 marks

There shall be continuous evaluation during the semester for 40 marks as shown below:

Day-to-Day work and laboratory record	-	25 marks
One internal test at the end of the semester	-	15 marks
Total	-	**40 Marks**

ii. External Assessment :

At the end of the semester an examination for 3 hours duration shall be conducted for 60 marks by the concerned teacher and an external examiner.

6.3. Subjects such as Engineering Graphics, Engineering Drawing, Machine Drawing, Design and Drawing of R.C. Structures, Steel structures, Irrigation structures, Estimation cost and valuation, Building Planning and Drawing etc.

i. Internal assessment : 40 marks

a) There shall be continuous evaluation with a weightage of 40 marks as shown below :

Day-to-Day work	-	20 marks

b) Internal tests :

There shall be two internal tests One in the middle of the semester and the other at the end. Marks for Internal Tests = 0.8 x higher marks scored between the two tests + 0.2 x marks scored in the other test. - 20 marks

Total	-	**40 Marks**

ii. External assessment :

Same as for theory subjects given in 6.1.ii.

6.4. Mini Project /Term paper

There shall be a Mini Project/Term paper in the III year I / II semester. It has a weightage of 50 marks and evaluated internally at the end of the semester.

6.5. Project

Out of a total of 200 marks for the Project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination. The End Semester Examination (Viva-voce) shall be conducted by the committee. The committee consists of an external examiner, Head of the Department and Supervisor of the Project. The Evaluation of project work shall be conducted at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project and evaluated by an internal committee.

6.6. Seminar

For the Seminar, Each student has to be evaluated based on the presentation of any latest topic with a report of 10-15 pages and a power point presentation of minimum 10 slides. The student shall collect the information on a specialized topic and prepare a technical report, showing his understanding of 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.

7. MINIMUM ACADEMIC REQUIREMENTS

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned under rule 5.

7.1. A Student is deemed to have satisfied the minimum academic requirements if he has **earned the credits allotted to each theory / practical design / drawing subject by securing not less than 35% of marks in the end semester exam, and minimum 40% of marks in the sum total of the internal marks and end semester examination marks.**

7.2. A Student is deemed to have satisfied the minimum academic requirements if he has **earned the credits allotted to each laboratory / project by securing not less than 40% of marks in the end semester exam, and minimum 50% of marks in the sum total of the internal marks and end semester examination marks.**

7.3. A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to mini project/term paper and seminar by securing not less than 50% of Marks.

7.4. A student shall register and put in minimum attendance in all 180 credits and earn all 180 credits.

8. COURSE PATTERN

8.1. The entire course of study is for four academic years, all the years are on semester pattern.

8.2. A student eligible to appear for the end semester examination in a subject, but absent or failed in the end semester examination, may write the examination in that subject when conducted next.

8.3. When a student is detained due lack of credits / shortage of attendance, he may be re-admitted into the same semester / year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

9. PROMOTION TO NEXT HIGHER CLASS

9.1. A Student shall be promoted from 1st year to II year if he fulfills the minimum attendance requirement under rule 5.

9.2. A Student shall be promoted from II year to III year, if he fulfills the academic requirement of 50% of the credits upto II year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.

9.3. A student shall be promoted from III year to IV year if he fulfills the academic requirements of 50% of the credits upto III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

10. CUMULATIVE GRADE POINT AVERAGE (CGPA)

Theory/Design/ Drawing (%)	Laboratory/Mini Project/Term Paper/ Project/ Seminar (%)	Letter Grade	Level	Grade Point
≥ 90	≥ 90	O	Outstanding	10
≥ 80 to < 90	≥ 80 to < 90	S	Excellent	9
≥ 70 to < 80	≥ 70 to < 80	A	Very Good	8
≥ 60 to < 70	≥ 60 to < 70	B	Good	7
≥ 50 to < 60	≥ 50 to < 60	C	Fair	6
≥ 40 to < 50	--	D	Satisfactory	5
<40	<50	F	Fail	0
			Absent	0

Computation of Semester Grade Point Average (SGPA)

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

The **SGPA** is the ratio of sum of 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.

$$\textbf{SGPA (Si)} = \sum(Ci \times Gi) / \sum Ci$$

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 semester of a programme i.e.,

$$\textbf{CGPA} = \sum(Ci \times Si) / \sum Ci$$

- Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.
- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- Equivalent Percentage = (CGPA – 0.75) x 10

11. 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 shall be placed in one of the following four classes.

Class Awarded	CGPA to be secured	
First Class with Distinction	≥ 7.75 (Without any Supplementary Appearance)	**From the CGPA secured from 180 credits**
First Class	≥ 6.75 to < 7.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 4.75 to < 5.75	

12. WITHHOLDING OF RESULTS :

If the students has not paid the dues, if any, to the college or if any case of indiscipline or malpractice is pending against him, the examination results of the student will be withheld.

13. TRANSITORY REGULATIONS:

13.1. For Re-admitted Candidates:

i) A student who is following JNTUK curriculum and detained due to shortage of attendance at the end of the first semester of first year shall join the autonomous batch of first year first semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

ii) A student who is following JNTUK curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of first year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the Programme prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree.

iii) However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects will be offered in place of them as decided by the Board of Studies.

iv) The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream.

The class will be awarded based on the academic performance of a student in the autonomous pattern.

v) In case the students who do not have option of acquiring required credits with the existing courses offered as per the curriculum under autonomy, credit balance can be achieved by clearing the additional courses offered. The additional courses that are offered can be of theory or laboratory courses.

13.2. Transfer candidates (from non-autonomous college affiliated to JNTUK):

i) A student who is following JNTUK curriculum, transferred from other college to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the Programme prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree.

ii) However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies.

iii) The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

iv) In case the students who do not have option of acquiring required credits with the existing courses offered as per the curriculum under autonomy, credit balance can be achieved by clearing the additional courses offered. The additional courses that are offered can be of theory or laboratory courses.

13.3. Transfer candidates (from an autonomous college affiliated to JNTUK):

i) A student who has secured the required credits upto previous semesters as per the regulations of other autonomous institutions shall also be permitted to be transferred to this college.

ii) A student who is transferred from the other autonomous colleges to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the Programme prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree.

iii) However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester as per the regulations of the college from which he is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

iv) In case the students who do not have option of acquiring required credits with the existing courses offered as per the curriculum under autonomy, credit balance can be achieved by clearing the additional courses offered. The additional courses that are offered can be of theory or laboratory courses.

ACADEMIC REGULATIONS FOR B.TECH LATERAL ENTRY SCHEME (LES)

Applicable for the students admitted into II year B.Tech I semester from the Academic year 2017-18.

1. AWARD OF B.TECH DEGREE

A Student will be declared eligible for the award of B.Tech Degree if he fulfills the following academic regulations.

1.1. A Student shall be declared eligible for the award of the B.Tech Degree, if he pursues a course of study for not less than three academic years and not more than six academic years.

1.2 The candidate shall register for 132 credits and secure all the 132 credits.

2. The attendance regulations of B.Tech (Regular) shall be applicable to B.Tech (LES) students as well.

3 PROMOTION RULES

3.1. A Student shall be promoted from II year to III year, if he fulfills the minimum attendance requirement under rule 5 of B.Tech (Regular).

3.2. A student shall be promoted from III year to IV year if he fulfills the academic requirements of 50% of the credits upto III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

4. 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 shall be placed in one of the following four classes.

Class Awarded	CGPA to be secured	
First Class with Distinction	≥ 7.75 (Without any Supplementary Appearance)	**From the CGPA secured from 132 credits**
First Class	≥ 6.75 to < 7.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 4.75 to < 5.75	

5. All the other regulations as applicable to **B.Tech 4-year degree course (Regular) will hold good for B.Tech (Lateral Entry Scheme) also.**

GENERAL :

i) Whenever the words “he”, “him”, “his” secure in the regulations, they include “she”, “her”, “hers”.

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

iii) In case of any doubt or ambiguity in the interpretation of rules, the decision of the Principal of the college is final.

iv) The college may change or amend the academic rules and regulations or syllabi at any time and the changed rules come into effect from the date of issue of such orders.

MALPRACTIES RULES

Disciplinary Action for / Improper Conduct in Examinations

	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
1. (a)	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 subject 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 subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	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 subject 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.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	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 subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year.

		The candidate is also debarred for two consecutive semesters from class work and all University 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	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 subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	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 subject.
6	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 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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects 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.

	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	
7	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 subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.

Malpractices identified by special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)

(i) A show cause notice shall be issued to the college.

(ii) Impose a suitable fine on the college.

(iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

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Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

	Imprisonment upto		Fine Upto
Teasing, Embarrassing & Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

In Case of Emergency CALL TOLL FREE No. : 1800 - 425 - 1288

LET US MAKE PRAGATI A RAGGING FREE COLLEGE

ABSOLUTELY NOT TO RAGGING

1. **Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.**
2. **Ragging entails heavy fines and/or imprisonment.**
3. **Ragging invokes suspension and dismissal from the College.**
4. **Outsiders are prohibited from entering the College and Hostel without permission.**
5. **Girl students must be in their hostel rooms by 7.00 p.m.**
6. **All the students must carry their Identity Cards and show them when demanded.**
7. **The Principal and the Wardens may visit the Hostels and inspect the rooms any time.**

R16 COURSE STRUCTURE of ECE

I Year **I SEMESTER**

Sub Code	Subjects	L	T	P	Credits
16BH1T01	English – I	3	1	--	3
16BH1T03	MATHEMATICS-I	3	1	--	3
16BH1T05	MATHEMATICS-II (Numerical Methods and Complex Variables)	3	1	--	3
16BH1T10	Applied Physics	3	1	--	3
16BH1T13	Environmental Studies	3	1	--	3
16ME1T02	Engineering Drawing	1		3	3
16BH1L01	English - Communication Skills Lab -1	--		3	2
16BH1L03	Engineering/Applied Physics Laboratory	--		3	2
16BH1L04	Engineering Physics – Virtual Labs - Assignments	--		2	--
16ME1L01	Engineering Workshop& IT Workshop	--		3	2
Total credits					**24**

I Year **II SEMESTER**

Sub Code	Subjects	L	T	P	Credits
16BH2T02	English – II	3	1	--	3
16BH2T06	MATHEMATICS-III	3	1	--	3
16BH2T12	Applied Chemistry	3	1	--	3
16EE2T02	Electrical and Mechanical Technology	3	1	--	3
16CS2T01	Computer Programming using C	3	1	--	3
16EC2T01	Basic Network Theory	3	1	--	3
16BH2L05	Applied Chemistry Laboratory	--		3	2
16BH2L02	English - Communication Skills Lab -2	--		3	2
16BH2L01	C Programming Lab	--		3	2
Total credits					24

II Year **I Semester**

Sub Code	Subjects	L	T	P	Credits
16EC3T03	Electronic Devices and Circuits	3	1		3
16EC3T04	Control Systems	3	1		3
16EC3T05	Signals and Systems	3	1		3
16EC3T06	Network Analysis and Synthesis	3	1		3
16EC3T07	Switching Theory and Logic Design	3	1		3
16BH3T14	Managerial Economics & Financial Analysis	3	1		3
16EC3L01	Electronic Devices and Circuits Lab			3	2
16EE3L02	Networks & Electrical Technology Lab			3	2
Total credits					**22**

II Year **II Semester**

Sub Code	Subjects	L	T	P	Credits
16EC4T09	Electronic Circuit Analysis	3	1		3
16EC4T10	Random Variables and Stochastic Process	3	1		3
16EC4T11	Electromagnetic Waves and Transmission Lines	3	1		3
16EC4T12	Analog Communications	3	1		3
16EC4T13	Pulse and Digital Circuits	3	1		3
16CS4T12	Data Structures	3	1		3
16EC4L02	Electronic Circuit Analysis Lab			3	2
16EC4L03	Analog Communications Lab			3	2
Total credits					**22**

III Year **I Semester**

Sub Code	Subjects	L	T	P	Credits
16CS5T14	Computer Architecture and Organization	3	1		3
16EC5T14	Linear I C Applications	3	1		3
16EC5T15	Digital I C Applications	3	1		3
16EC5T16	Digital Communications	3	1		3
16EC5T17	Antennas and Propagation	3	1		3
16EC5L04	Pulse and Digital Circuits & I C Applications Lab			3	2
16EC5L05	Digital Communications Lab			3	2
16EC5L06	Digital I C Applications Lab			3	2
16BH5T17	Professional Ethics & Human Values		3		--
16EC5M01	MOOCs		3		
Total credits					**21**

III Year **II Semester**

Sub Code	Subjects	L	T	P	Credits
16EC6T19	Digital Signal Processing	3	1		3
16EC6T20	Micro Processors & Micro Controllers	3	1		3
16EC6T21	VLSI Design	3	1		3
16BH6T15	Management Science	3	1		3
16CS6E06 16CS6E07 16ME6E01 16EE6E03 16EC6E02 16EE6E04	**OPEN ELECTIVE** 1. OOPs through Java 2. Data Mining 3. Robotics 4. Power Electronics 5. Bio-Medical Instrumentation 6.MEMS	3	1		3
16EC6L08	Micro Processors & Micro Controllers Lab			3	2
16EC6L09	VLSI Lab			3	2
16EC6P01	Mini Project			3	2
16BH6T16	IPR & Patents		2		--
Total credits					**21**

IV Year **I Semester**

Sub Code	Subjects	L	T	P	Credits
16CS7T15	Computer Networks	3	1		3
16EC7T22	Digital Image Processing	3	1		3
16EC7T23	Micro Wave Engineering	3	1		3
16EC7T24	Optical Communications	3	1		3
16EC7D01 16EC7D02 16EC7D03	**Elective I** 1. Digital TV Engineering 2. Radar Engineering 3. System Design through Verilog	3	1		3
16EC7D04 16EC7D05 16EC7D06	**Elective II** 1.Embedded Systems 2. Analog IC Design 3.Network security & Cryptography	3	1		3
16EC7L10	Micro Wave Engineering & Optical Lab			2	2
16EC7L11	Digital Signal Processing Lab			2	2
Total credits					**22**

IV Year **II Semester**

Sub Code	Subjects	L	T	P	Credits
16EC8T25	Cellular Mobile Communications	3	1		3
16EC8T26	Electronic Measurements and Instrumentation	3	1		3
16EC8T27	Satellite Communications	3	1		3
16EC8D07 16EC8D08 16IT8D19 16IT8D20	**Elective III** 1.Wireless sensors & Actuator Networks 2. Digital IC Design 3. Web Technologies 4. Python	3	1		3
16EC8S01	Seminar		3		2
16EC8P02	Project				10
Total credits					**24**

Total course credits = 48+44 + 42 + 46 = 180

ENGLISH-I	L	T	P	C
	3	1	0	3
I Year I Semester	Subject Code: 16BH1T01			

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Enables the learners to acquire knowledge in different fields besides the acquisition of Reading and Writing skills to apply in their real-life situations.	Applying
CO2	Explains the learners about transport and road safety methods to make use of them in that phenomenon and extends their reading and writing skills	Understanding
CO3	Creates awareness on importance of mass production in the survival of mankind and strengthens them in reading and writing aspects	. Understanding
CO4	Helps the learners to identify the required sources of energy for rural India and practice their reading and writing skills	Analyzing
CO5	Creates awareness in the readers on ecological system and supports the learners in improving reading and writing skills	Creating
CO6	Prepares the learners to have an industrial etiquette and training and promotes their reading and writing skills	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	0	0	1	0	0	0	0	0	0	1	0	0	0
CO2	2	0	0	0	0	2	0	1	0	0	0	0	0	0
CO3	0	0	0	0	1	0	0	0	0	0	0	0	0	0
CO4	1	0	0	0	1	0	0	0	0	0	0	0	0	0
CO5	0	0	1	0	0	0	1	1	0	0	0	0	0	0
CO6	1	0	0	0	0	1	0	1	1	1	0	0	0	0

Introduction:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training the students have to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of the students of Engineering. As far as the detailed Textbooks are concerned, the focus should be on the skills of listening, speaking, reading

and writing. The non-detailed Textbooks are meant for extensive reading for pleasure and profit. Thus, the stress in the syllabus is primarily on the development of communicative skills and fostering of ideas.

Objectives:

1. To improve the language proficiency of the students in English with emphasis on LSRW skills.
2. To enable the students to study and comprehend the prescribed lessons and subjects more effectively relating to their theoretical and practical components.
3. To develop the communication skills of the students in both formal and informal situations.

LISTENING SKILLS:

Objectives:

1. To enable the students to appreciate the role of listening skill and improve their pronunciation.
2. To enable the students to comprehend the speech of people belonging to different backgrounds and regions.
3. To enable the students to listen for general content, to fill up information and for specific information.

SPEAKING SKILLS:

Objectives:

1. To make the students aware of the importance of speaking for their personal and professional communication.
2. To enable the students to express themselves fluently and accurately in social and professional success.
3. To help the students describe objects, situations and people.
4. To make the students participate in group activities like role-plays, discussions and debates.
5. To make the students participate in Just a Minute talks.

READING SKILLS:

Objectives:

1. To enable the students to comprehend a text through silent reading.
2. To enable the students to guess the meanings of words, messages and inferences of texts ingiven contexts.
3. To enable the students to skim and scan a text.
4. To enable the students to identify the topic sentence.
5. To enable the students to identify discourse features.
6. To enable the students to make intensive and extensive reading.

WRITING SKILLS:

Objectives:

1. To make the students understand that writing is an exact formal skills.
2. To enable the students to write sentences and paragraphs.
3. To make the students identify and use appropriate vocabulary.
4. To enable the students to narrate and describe.
5. To enable the students capable of note-making.
6. To enable the students to write coherently and cohesively.
7. To make the students to write formal and informal letters.
8. To enable the students to describe graphs using expressions of comparison.
9. To enable the students to write technical reports.

Methodology:

1. The classes are to be learner-centred where the learners are to read the texts to get a comprehensive idea of those texts on their own with the help of the peer group and the teacher.
2. Integrated skill development methodology has to be adopted with focus on individual language skills as per the tasks/exercise.
3. The tasks/exercises at the end of each unit should be completed by the learners only and the teacher intervention is permitted as per the complexity of the task/exercise.
4. The teacher is expected to use supplementary material wherever necessary and also generate activities/tasks as per the requirement.
5. The teacher is permitted to use lecture method when a completely new concept is introduced in the class.

DETAILED TEXTBOOKS:

- ENGLISH FOR ENGINEERS AND TECHNOLOGISTS, Published by Orient Blackswan Pvt. Ltd
- THE COP AND THE ANTHEM BY O. HENRY PUBLISHED BY PERFECTION LEARNING

NON-DETAILED TEXTBOOK:

- -PANORAMA: A COURSE ON READING, Published by Oxford University Press India

The course content along with the study material is divided into six units.

UNIT I:

1. 'Human Resources' from English for Engineers and Technologists.
   Objective:
   To develop human resources to serve the society in different ways.
   Outcome:
   The lesson motivates the readers to develop their knowledge different fields and serve the society accordingly.
2. 'An Ideal Family' from Panorama: A Course on Reading
   Objective:
   To develop extensive reading skill and comprehension for pleasure and profit.
   Outcome:
   Acquisition of writing skills

UNIT 2:

1. ‘Transport: Problems and Solutions' from English for Engineers and Technologists.
   Objective:
   To highlight road safety measures whatever be the mode of transport.
   Outcome:
   The lesson motivates the public to adopt road safety measures.
2. 'War' from 'Panorama : A Course on Reading'
   Objective:
   To develop extensive reading skill and comprehension for pleasure and profit.
   Outcome:
   Acquisition of writing skills

UNIT 3:

Unit 3 has two sections: Unit 3(A) and 3(B)

3(A):

1. 'Evaluating Technology' from English for Engineers and Technologists.
   Objective:

To highlight the advantages and disadvantages of technology.

Outcome:

The lesson creates awareness in the readers that mass production is ultimately survival.

2. 'The Verger' from 'Panorama : A Course on Reading' • 1. THE COP AND THE ANTHEM BY O.HENRY

Objective:

To develop extensive reading skill and comprehension for pleasure and profit.

Outcome:

Acquisition of writing skills

Unit 3(B)

Objective:

To enable students to develop interest in reading and appreciating short stories of different genres.

Outcome:

This lesson motivates students to respond and express the ideas and feelings in the story through oral, written and performative means.

UNIT 4:

1. 'Alternative Sources of Energy' from English for Engineers and Technologists.

Objective:

To bring into focus different sources of energy as alternatives to the depleting sources.

Outcome:

The lesson helps to choose a source of energy suitable for rural India.

2. ' The Scarecrow' from Panorama : A Course on Reading

Objective:

To develop extensive reading skill and comprehension for pleasure and profit.

Outcome:

Acquisition of writing skills.

UNIT 5:

1. 'Our Living Environment' from English for Engineers and Technologists.

Objective:

To highlight the fact that animals must be preserved because animal life is precious. **Outcome:** The lesson creates an awareness in the reader as to the usefulness of animals for the human society.

2. 'A Village Host to Nation' from Panorama : A Course on Reading

Objective:

To develop extensive reading skill and comprehension for pleasure and profit.

Outcome:

Acquisition of writing skills

UNIT 6:

1. ' Safety and Training' from English for Engineers and Technologists.

Objective:

To highlight the possibility of accidents in laboratories, industries and other places and to follow safety measures.

Outcome:

The lesson helps in identifying safety measures against different varieties of accidents at home and in the workplace.

2. 'Martin Luther King and Africa' from Panorama : A Course on Readin

Objective:

To develop extensive reading skill and comprehension for pleasure and profit.

Outcome:

Acquisition of writing skills

NOTE:

All the exercises given in the prescribed lessons in both detailed and non-detailed textbooks relating to the theme and language skills must be covered.

MATHEMATICS – I	L	T	P	C
	3	1	0	3
I Year I Semester	Subject Code: 16BH1T03			

Course Objectives:

1. The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2. The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO-1	Solve the linear system of equations by using different methods.	Applying
CO-2	Find the Eigen values and Eigen vectors and also finding inverse and power of a matrix by using Cayley - Hamilton theorem.	Applying
CO-3	Find rank, index, signature and nature of a Quadratic form.	Applying
CO-4	Solve first order differential equations and able to apply physical Problems.	Applying
CO-5	Solve higher order linear differential equations with constant Coefficients.	Analyzing
CO-6	Find partial derivate of different orders, finding maxima and minima of a function of two variable, three variables and functional dependence.	Understanding

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	0	0	0	0	0	0	0	0	0	0	0
CO2	3	3	2	0	0	0	0	0	0	0	0	0	0	0
CO3	3	3	1	0	0	0	0	0	0	0	0	0	0	0
CO4	3	3	3	0	0	0	0	0	0	0	0	0	0	0
CO5	3	3	3	0	0	0	0	0	0	0	0	0	0	0
CO6	3	3	2	0	0	0	0	0	0	0	0	0	0	0

UNIT I: Linear systems of equations

Rank-Echelon form-Normal form – Solution of linear systems – Gauss elimination - Gauss Jordon-Gauss Jacobi and Gauss Seidel methods.
Applications: Finding the current inelectrical circuits

UNIT II: Eigen values - Eigen vectors
Eigen values - Eigen vectors– Properties – Cayley-Hamilton theorem - Inverse and powersof a matrix by using Cayley-Hamilton theorem- Diagonalization.
Applications: Free vibration of a two-mass system.

UNIT III–Quadratic forms
Quadratic formsReduction of quadratic form to canonical form – Rank - Positive, negative and semi definite- Index – Signature.

UNIT IV: Differential equations of first order and first degree
Linear-Bernoulli-Exact-Reducible to exact.
Applications: Newton's Law of cooling-Law of natural growth and decay-Or thogonal trajectories-Electrical circuits- Chemical reactions.

UNIT V: Linear differential equations of higher order
Non-homogeneous equations of higher order with constant coefficients with RHS term of the type$e$,sin ax, cos ax, polynomials in x, ax V ,$xV(x)$ −Method of Variation of parameters.
Applications: LCR circuit, Simple Harmonic motion.

UNIT VI: Partial differentiation
Introduction-Homogeneous function-Euler's theorem-Total derivative-Chain rule Generalized Mean value theorem for single variable (without proof)-Taylor's and McLaurent's series expansion of functions of two variables-Jacobian– Functional dependence.
Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. N.P.Bali, Engineering Mathematics, Lakshmi Publications.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India

Reference Books:

1. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
2. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
3. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
4. Srimanta Pal, SubodhC.Bhunia, Engineering Mathematics, Oxford UniversityPress.
5. Dass H.K., RajnishVerma. Er, Higher Engineering Mathematics, S. Chand Co.Pvt. Ltd, Delhi.

MATHEMATICS – II (Numerical Methods and Complex Variable)	L	T	P	C
	3	1	0	3
I Year I Semester	Subject Code: 16BH1T05			

Course Objectives:

1. The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2. The skills derived from the course will help the student from a necessary baseto develop analytic and design concepts.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Solve the algebraic and transcendental Equation by using numerical method.	Applying
CO2	Finding the required functional volume using interpolation formulae with equal and unequal intervals.	Understanding
CO3	Evaluate the given integral using numerical methods by different formulae	Applying
CO4	Express the given function into Fourier series in the given interval. Find range of sine and cosine series in the given interval.	Applying
CO5	Find the Fourier integral and transforms of a given function and Fourier sine and cosine transform of a given function.	Applying
CO6	Find the partial derivative by elimination of arbitrary function and arbitrary constant. Solve the liner and non-liner PDEs.	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	0	0	0	0	0	0	0	0	0	0	0
CO2	3	3	2	0	0	0	0	0	0	0	0	0	0	0
CO3	3	3	2	0	0	0	0	0	0	0	0	0	0	0
CO4	3	3	1	0	0	0	0	0	0	0	0	0	0	0
CO5	3	3	1	0	0	0	0	0	0	0	0	0	0	0
CO6	3	3	2	0	0	0	0	0	0	0	0	0	0	0

UNIT I: Solution of Algebraic and Transcendental Equations

Introduction- Bisection method – Method of false position – Iteration method – Newton Raphson

method (Onevariable and simultaneous Equations).

UNITII: Interpolation Introduction- Errors in polynomial interpolation – Finite differences- Forward differences- Backward differences –Central differences – Symbolic relations and separation of symbols - Differences of a polynomial-Newton'sformulae for interpolation – Interpolation with unequal intervals - Lagrange's interpolation formula.

UNIT III: Numerical Integration and solution of Ordinary Differential equations

Trapezoidal rule- Simpson's 1/3rd and 3/8th rule-Solution of ordinary differential equations by Taylor's seriesPicard's method of successive approximations-Euler's method - Runge-Kutta method (second and fourth order).

UNIT IV: Fourier Series

Introduction- Periodic functions – Fourier series of -periodic function - Dirichlet's conditions Even and odd functions –Change of interval– Half-range sine and cosine series.

UNIT V: Fourier Transforms

Fourier integral theorem (without proof) – Fourier sine and cosine integrals - sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT VI: Partial Differential Equations

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

Applications: Method of separation of Variables- Solution of One dimensional Wave, Heat and two dimensional Laplace equations.

Text Books

1. **B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **N.P.Bali**, Engineering Mathematics, Lakshmi Publications.
3. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.

Reference Books:

1. **Dean G. Duffy** engineering mathematics with MATLAB, CRC, Advanced Press
2. **V.Ravindranath** and **P.Vijayalakshmi**, Mathematical Methods, Himalaya Publishing House.
3. **David Kincaid, Ward Cheney**,
4. Numerical Analysis-Mathematics of Scientific Computing, 3rd Edition, Universities Press.
5. **Srimanta Pal, SubodhC.Bhunia**, Engineering Mathematics, Oxford University Press.
6. **Dass H.K., RajnishVerma. Er.**, Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.

APPLIED PHYSICS	L	T	P	C
	3	1	0	3
I Year I Semester	Subject Code: 16BH1T10			

COURSE OBJECTIVES:

Physics curriculum which is re-oriented to the needs of Circuital branches of graduate engineering courses. That serves as a transit to understand the branch specific advanced topics. The courses are designed to:

1. Impart Knowledge of Physical Optics phenomena like Interference, Diffraction and Polarization involving required to design instruments with higher resolution.
2. Teach Concepts of coherent sources, its realization and utility optical instrumentation.
3. 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.
4. Understand the physics of Semiconductors and their working mechanism for their utility in sensors.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	The students will recognize, associate to apply the concepts of Interference to undergo analysis of optical effects and contribute to engineering applications.	Understanding
CO2	The students will relate to studies on diffraction pattern of light to utilize in the analysis of the materials and their properties.	Applying
CO3	The students will understand concepts of polarization phenomenon, Lasers and their practical role play in engineering applications.	Understanding
CO4	The students will learn to study diffraction pattern of light to utilize in the analysis of the materials and their properties &to analyze the applications of the Optical fibers in the field of communication.	Applying
CO5	The students will learn the phenomenon of electrical & thermal Conductivities related to sub-microscopic particles.	Analyzing
CO6	The students will be empowered to apply the basics of electronics in engineering applications	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	0	1	2	0	0	0	0	0	0	1	0	0
CO2	2	2	1	1	2	1	0	0	0	0	0	1	0	0
CO3	1	0	2	1	0	2	0	0	0	0	0	1	0	0
CO4	2	1	0	0	2	1	0	0	0	0	0	1	0	0
CO5	2	1	0	0	1	0	0	0	0	0	0	1	0	0
CO6	2	1	0	0	2	0	0	0	0	0	0	2	0	0

UNIT-I

Objective: To impart knowledge on interference phenomenon and utilizing it to design o instruments in Engineering applications.

INTERFERENCE: Introduction-Principle of Superposition – Coherent Sources – Interference in thin films (reflection geometry)- Interference in wedge shaped films – Newton's rings –working principle of Interferometer, applications

UNIT-II

Objective: To impart knowledge on diffraction phenomenon to design optical instruments for Engineering applications.

DIFFRACTION: Introduction –Fraunh offer diffraction at single slit - Cases of double slit, N-slits & Circular Aperture (Qualitative treatment only)-Grating equation - Resolving power of a grating, Telescope and Microscopes- applications.

UNIT-III

Objective:

To impart knowledge on types of polarization, types of polarizing materials and their effects to study and design of optical instruments.

To impart knowledge on the lasers & their working principle

POLARIZATION: Introduction -Types of Polarization – Methods of production – double refraction- Nicol Prism -Quarter wave plate and Half Wave plate – Working principle of Polari meter (Sacharimeter)- applications.

LASERS: Introduction- Characteristics– Stimulated emission – Einstein's Transition Probabilities- Pumping schemes - Ruby laser – Helium Neon laser-applications of lasers

UNIT-IV

Objective:

- An overview of the Maxwell's Electromagnetic Field Equations & studies the concepts regarding the response of materials to EM fields.
- To impart knowledge on the Optical Fibers and transmission of signals through it.

ELECTROMAGNETIC FIELDS: Introduction-Scalar and Vector Fields – Electric Potential-Gradient, Divergence of fields – Gauss and Stokes theorems-Propagation of EM waves through

dielectric medium- Applications.

FIBER OPTICS: Introduction, Principle of Optical Fiber – Total Internal Reflection, Working principle of an Optical fiber, Numerical Aperture and Acceptance Angle-classification of Optical fibres-Applications.

UNIT-V

Objective:

- To impart knowledge on the discrepancy of classical mechanics & role of quantum mechanics in explaining phenomenon related to sub-microscopic particles..

QUANTUM MECHANICS: Introduction - Matter waves – Schrödinger Time Independent and Time Dependent wave equations – Particle in a box.

FREE ELECTRON THEORY: Introduction-Defects of Classical free electron theory –resistance of Conductor-Quantum Free electron theory - concept of Fermi Energy-Fermi Energy level of Conductors-Density of States.

UNIT-VI

Objective:

- To impart knowledge on the physics of semiconductors and their working principle fortheir utility in electronics.

BAND THEORY OF SOLIDS: Introduction -Bloch's theorem (qualitative) – Kronig – Penney model – energy bands in crystalline solids – classification of crystalline solids– effective mass of electron & concept of hole.

SEMICONDUCTOR PHYSICS: Introduction-Conduction – Density of carriers in Intrinsic and Extrinsic semiconductors- Conductivity and Carrier concentration – Drift & Diffusion – relevance of Einstein's equation- Hall effect and its applications.

COURSE 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.

Text Books:

1. A Text book of Engineering Physics – by Dr. M.N.Avadhanulu and Dr.P.G.Kshira sagar, S.Chand & Company Ltd., (2014)
2. 'Solid State Physics' by A.J.Dekker, Mc Millan Publishers (2011)

Reference Books :

1. Physics by Resnick,Halliday&Krane ,Volume I&II ,John Wiley&sons(2002)
2. Engineering Physics by D.K.Bhattacharya and Poonam Tandon , Oxford press (2015)
3. Applied Physics by P.K.Palanisamy , Scitech publications (2014)

Lasers and Non-Linear optics by B.B.Laud , Newage international publishers (2008

ENVIRONMENTAL STUDIES	L	T	P	C
	3	1	0	3
I Year I Semester	Subject Code: **16BH1T13**			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Create awareness on global environment problems including the ecosystem and its production and its challenges	Creating
CO2	Learn importance of natural resources and their conservations for sustenance	Analyzing
CO3	Identify the threats to biodiversity and its conservation for different strategies	Applying
CO4	Focus on the origins, pathways and consequences of anthropogenic activities in the environment as well as the approaches to control pollution and its remediation	Remembering
CO5	Understand the important environmental problems and environmental legislations for sustainable development	Applying
CO6	Applications of environmental management systems to an industry for sustenance	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	3	1	2	1	3	1	1	0	0	0	0	0
CO2	0	1	1	0	0	0	2	2	2	0	0	0	0	0
CO3	0	0	0	0	0	0	2	2	0	0	0	0	0	0
CO4	2	1	3	2	0	1	1	0	2	0	0	3	0	0
CO5	1	1	2	1	0	3	3	2	1	0	0	0	0	0
CO6	2	3	3	3	3	2	2	1	0	2	1	0	0	0

UNIT – I

Course Learning Objectives: Basic understanding of the environment, global problems and ecosystems.

Multidisciplinary nature of Environment and Ecology: Definition, Scope and Importance, Introduction to Brief works of noted Environmentalists & Naturalists (Wangari Mathai,Salim Ali and Sunderlal Bahuguna) ,Sustainability: Stockholm and Rio Summit–Global

Environmental Challenges: Global warming and climate change, Carbon Credits, acid rains, ozone layer depletion, population growth and explosion, effects. Role of information Technology in Environment and human health.

Ecosystems: Concept of an ecosystem**,** Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. Classification of ecosystems- characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems: Estuaries and Mangroves

UNIT – II

Course Learning Objectives: Overall understanding of the natural resources

Natural Resources: Natural resources and associated problems Forest resources – Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Sustainable mining of Granite, Laterite, Coal, Sea and River sands. 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 Vs Oil and Natural Gas Extraction. Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT – III

Course Learning Objectives: Basic understanding of Biodiversity.

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

UNIT – IV

Course Learning Objectives: Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities

Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Heavy Metal pollution, Soil pollution, Noise pollution, Radioactive pollution: Sources and risks. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Style, Impact of Fire Crackers on Man and his well being.

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

UNIT – V

Course Learning Objectives: Awareness on the social issues, environmental legislation and global treaties

Social Issues and the Environment: Urban problems related to energy -Water conservation-Coastal Regulatory zone management, 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 – VI

Course Learning Objectives: An understanding of the environmental impact of developmental activities

Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Environmental Modeling: Definition (Box Model and Gaussian Plume Modeling), Ecotourism, Green Campus – Green business, Green politics and Green Building.

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

TEXT BOOKS:

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

REFERENCE:

1. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014
5. Environmental pollution, Monitoring and Control by Khopkar.S.M, New Age Publishers. Text Book of Fundamentals of Ecol

ENGINEERING DRAWING	L	T	P	C
	1	0	3	3
I Year I Semester	Subject Code: 16ME1T02			

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 Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Construct polygons, curves and scales.	Applying
CO2	Identify the position of points and lines.	Applying
CO3	Identify the position of lines when inclined to both the planes.	Applying
CO4	Analyze the location and position of plane figures.	Analyzing
CO5	Analyze the location and position of solid bodies.	Analyzing
CO6	Develop an Isometric view and orthographic views.	Creating

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	1	1	0	0	0	0	0	0	0	0	3	0	1
CO2	3	3	1	0	0	0	0	0	0	0	0	0	3	0	1
CO3	3	3	1	0	0	0	0	0	0	0	0	0	3	0	0
CO4	3	3	1	3	2	0	0	0	1	0	0	0	3	0	1
CO5	3	3	1	3	2	0	0	0	1	0	0	0	3	0	1
CO6	3	3	3	3	3	0	0	0	3	0	3	0	3	0	3

Unit I

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

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 the reference planes (HP, VP or PP)

Unit III

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

Projections of 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 nclined 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. Bhatt, Chariot Publications
2. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age International

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, McGrawHill Publishers
4. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers
5. http://nptel.ac.in/courses/112103019/
6. http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html
7. http://www.engineeringdrawing.org

ENGLISH - COMMUNICATION SKILLS LAB- I	L	T	P	C
			3	2
I Year I Semester	Subject Code: 16BH1L01			

Objective:

To enable the students to learn through practice the communication skills of listening, speaking, reading and writing.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Distinguish spoken language & use it appropriately with clarity and confidence by choosing the right expressions according to social and professional contexts.	Analyzing
CO2	Interpret and responding appropriately in various day to day contexts and to demonstrate the need of learning speech sounds.	Evaluating
CO3	Identify the sounds of English and improve their pronunciation and to utilize the stress and intonation in their pronunciation according to the context which in turn reduces the mother tongue influence.	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	0	0	2	1	0	0	0	0	2	3	0	0	0	0
CO2	0	0	1	1	0	0	0	0	1	3	0	0	0	0
CO3	0	0	1	0	0	0	0	0	1	2	0	0	0	0

UNIT 1:

1. WHY study Spoken English?
2. Making Inquiries on the phone, thanking and responding to Thanks -- Practice work.

UNIT 2:

1. Responding to Requests and asking for Directions -- Practice work.

UNIT 3:

1. Asking for Clarifications, Inviting, Expressing Sympathy, Congratulating
2. Apologizing, Advising, Suggesting, Agreeing and Disagreeing -- Practice work.

UNIT 4:

1. Letters and Sounds -- Practice work.

UNIT 5:

1. The Sounds of English -- Practice work.

UNIT 6:

1. Pronunciation
2. Stress and Intonation -- Practice wor

Reference Books:

1. Strengthen your communication skills by Dr M Hari Prasad, Dr Salivendra Rajuand Dr Suvarna Lakshmi, MarutiPublications.
2. English for Professionals by Prof Eliah, B.S Publications, Hyderabad.
3. Unlock, Listening and speaking skills 2, Cambridge University Press
4. Spring Board to Success, Orient BlackSwan
5. A Practical Course in effective english speaking skills,PHI
6. Word power made handy, Dr shalini verma, SchandCompany
7. Let us hear them speak, Jayashree Mohanraj, Sagetexts.
8. Professional Communications, Aruna Koneru, Mc GrawhillEducation
9. Cornerstone, Developing soft skills, Pearson Education

ENGINEERING/APPLIED PHYSICS LAB	L	T	P	C
	0	0	3	2
I Year I Semester	Subject Code: 16BH1L03			

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Students will learn to utilize the basics of Interference, Diffraction in Physics through experimentation	Understanding
CO2	Students will be able to interpret and analyze concepts of Waves and Oscillations through experimentation	Understanding
CO3	Students will be able to apply the basics of Current and Electricity, Semiconductors in engineering projects	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	0	0	0	1	0	0	0	2	0	0	0	0	0
CO2	2	0	0	0	1	0	0	0	2	0	0	0	0	0
CO3	2	0	2	0	1	0	0	0	2	0	0	0	0	0

1. To verify the Laws of Transverse vibrations of a stretched string using sonometer
2. To determine the Rigidity Modulus of a given wire using Torsional Pendulum
3. To determine the velocity of sound in air using Volume Resonator Method
4. To determine the acceleration due to gravity using Compound Pendulum
5. To determine the frequency of an electric tuning fork using Melde's Apparatus
6. To Study the V-I Characteristics and determine voltage of a the breakdown Zener Diode
7. To determine the wavelength of a given source using diffraction Grating in normal incidence Method
8. To determine the energy Band Gap of a Semiconductor using P-N Junction diode
9. To Study the variation of the Magnetic field along the axis of a current carrying circular coil using Stewart and Gee's Apparatus
10. To study the R-I Characteristics of a Themistor

11. To determine the refractive index of the medium of the film using the formation of Newton's Rings.
12. To determine the thickness of a paper using the formation of parallel fringes
13. To Determine Planck's constant using photoconductor
14. To determine the refractive index of the Prism using spectrometer

References :

1. Engineering Physics Lab Manual by Dr.Y.Aparna & Dr.K.Venkatesswara Rao.(V.G.S. Book Links)
2. Physics Manual cum Observation book (College Designed Manual).

ENGINEERING/APPLIED PHYSICS-VIRTUAL LAB ASSIGNMENTS	L	T	P	C
	0	0	2	0
I Year I Semester	Subject Code: 16BH1L04			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Students will be able to have hands on experience on Computer simulations process.	Understanding
CO2	Students will be able to develop logical thinking to analyze critical reading/Data	Analyzing
CO3	Students will be able to handle & use other costly Equipment in a virtual environment in other streams	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	0	0	1	0	0	0	1	0	0	2	0	0
CO2	1	0	0	2	1	0	0	0	1	0	0	1	0	0
CO3	1	1	0	0	1	0	0	0	1	0	0	1	0	0

List of Experiments

1. Hall Effect
2. Crystal Structure
3. Hysteresis
4. Brewster's angle
5. Numerical Aperture of Optical fiber
6. Photoelectric Effect
7. Simple Harmonic Motion
8. LASER – Beam Divergence and Spot size
9. B-H curve
10. Miche son's interferometer

URL : **www.vlab.co.in**

ENGINEERING WORKSHOP AND IT WORKSHOP	L	T	P	C
	0	0	3	2
I Year I Semester	Subject Code: 16ME1L01			

Objective:

- 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?

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME
CO1	PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers.
CO2	Internet & World Wide Web introduces the different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet.
CO3	Usage of web browsers, email, newsgroups and discussion forums, awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber attacks will be introduced.
CO4	Productivity tools will enable the students in crafting professional word documents, excel spread sheets and power point presentations using the Microsoft suite of office tools and LaTeX.
CO5	Basic usage of MATLAB toolboxes will be introduced.

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, proxyand firewallsettings. 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 trouble shooting.
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,
2. K.L. James, Eastern EconomyEdition.
3. Microsoft Office 2007: Introductory Concepts and Techniques, Windows XP Edition by Gary B. Shelly, Misty E. Vermaat and Thomas J. Cashman (2007, Paperback).
4. LATEX- User's Guide and Reference manual, Leslie Lamport, Pearson, LPE, 2/e.
5. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers, Rudraprathap, Oxford University Press, 2002.
6. Scott Mueller's Upgrading and Repairing PCs, 18/e, Scott. Mueller, QUE, Pearson, 2008
7. The Complete Computer upgrade and repair book, 3/e, Cheryl A Schmidt, Dreamtech.
8. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech.
9. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.

ENGLISH-II	L	T	P	C
	3	1	0	3
I Year II Semester	Subject Code: 16BH2T02			

Objective:

1. To improve the language proficiency of the students in English with emphasis on LSRW skills.
2. To enable the students to study and comprehend the prescribed lessons and subjects more effectively relating to their theoretical and practical components.
3. To develop the communication skills of the students in both formal and informal situations.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Emphasizes that the ultimate aim of education is to enhance wisdom an inspires the readers the readers to serve their nation with their self enrichment.	Understanding
CO2	Enables the learners to promote peaceful co-existence and universal harmony in the society and empowers the learners to have initiation in innovation.	Applying
CO3	Imparts the students to manage different cultural shock due to globalization and to develop multiculturalism to appreciate diverse cultures and also motivates the learners to their nation.	Evaluating
CO4	Projects the needs of society to examine its outdated traditions and motivates the readers to strengthen their nation with their contribution to science and technology.	Creating
CO5	Outlines the necessity to protect environment for the sustainability of the future generation and influence the readers to face challenges in the extensive services to society.	Evaluating
CO6	Inspires the learners at the advancement of software by the eminent Personalities and motivates the readers to think and tap their innate tale.	Analyzing

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	-	-	-	-	-	-	2	1	-	-	3	-	-
CO2	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO3	-	-	1	-	-	2	-	-	-	-	-	-	-	-
CO4	-	-	1	-	-	-	-	2	0	-	-	-	-	-
CO5	-	-	1	-	-	-	2	-	1	-	-	-	-	-
CO6	-	-	-	-	1	-	-	-	-	1	-	-	-	-

LISTENING SKILLS

Objectives:

1. To enable the students to appreciate the role of listening skill and improve their pronunciation.
2. To enable the students to comprehend the speech of people belonging to different backgrounds and regions.
3. To enable the students to listen for general content, to fill up information and for specific information.

SPEAKING SKILLS

Objectives:

1. To make the students aware of the importance of speaking for their personal and professional communication.
2. To enable the students to express themselves fluently and accurately in social and professional success.
3. To help the students describe objects, situations and people.
4. To make the students participate in group activities like role-plays, discussions and debates.
5. To make the students participate in Just a Minute talks.

READING SKILLS

Objectives:

1. To enable the students to comprehend a text through silent reading.
2. To enable the students to guess the meanings of words, messages and inferences of texts in

given contexts.

3. To enable the students to skim and scan a text.
4. To enable the students to identify the topic sentence.
5. To enable the students to identify discourse features.
6. To enable the students to make intensive and extensive reading.

WRITING SKILLS

Objectives:

1. To make the students understand that writing is an exact formal skill.
2. To enable the students to write sentences and paragraphs.
3. To make the students identify and use appropriate vocabulary.
4. To enable the students to narrate and describe.
5. To enable the students capable of note-making.
6. To enable the students to write coherently and cohesively.
7. To make the students to write formal and informal letters.
8. To enable the students to describe graphs using expressions of comparison.
9. To enable the students to write technical reports.

Methodology:

1. The classes are to be learner-centered where the learners are to read the texts to get a comprehensive idea of those texts on their own with the help of the peer group and the teacher.
2. Integrated skill development methodology has to be adopted with focus on individual language skills as per the tasks/exercise.
3. The tasks/exercises at the end of each unit should be completed by the learners only and the teacher intervention is permitted as per the complexity of the task/exercise.
4. The teacher is expected to use supplementary material wherever necessary and also generate activities/tasks as per the requirement.
5. The teacher is permitted to use lecture method when a completely new concept is introduced in the class.

The following text books are recommended for study in I B.Tech II Semester (Common for all branches) of Pragati Engineering College, Surampalem from the academic year 2016-17 (R-16 Regulations)

DETAILED TEXTBOOK:

- ENGLISH ENCOUNTERS Published by Maruthi Publishers.
- A BETTER INDIA, A BETTER WORLD by N.R. Narayana Murthy, Published by: Penguin Books India Pvt. Ltd.

DETAILED NON-DETAIL:

- THE GREAT INDIAN SCIENTISTS, Published by Cengage learning
- The course content along with the study material is divided into six units.

UNIT 1:

1. ' The Greatest Resource- Education' from English Encounters

Objective:

Schumacher describes the education system by saying that it was mere training, something more than mere knowledge of facts.

2. ' A P J Abdul Kalam' from The Great Indian Scientists.

Objective:

The lesson highlights Abdul Kalam's contributions to Indian science and the awards he received.

UNIT 2:

1. ' A Dilemma' from English Encounters

Objective:

The lesson centers on the pros and cons of the development of science and technology.

2. 'C V Raman' from The Great Indian Scientists.

Objective:

The lesson highlights the dedicated research work of C V Raman and his achievements in Physics.

UNIT 3:

Unit 3 has two sections: Unit 3(A) and 3(B)

3 (A)

1. 'Cultural Shock': Adjustments to new Cultural Environments from English Encounters.

Objective:

The lesson depicts of the symptoms of Cultural Shock and the aftermath consequences

2. 'Homi Jehangir Bhabha' from The Great Indian Scientists.

Objective:

The lesson highlights Homi Jehangir Bhabha's contributions to Indian nuclear program as architect.

Unit 3 (B)

1.'What can we learn from West?' from A Better India, A Better World

Objective:

To enable students to appreciate the differences in cultural perspectives.

UNIT 4:

1. 'The Lottery' from English Encounters.

Objective:

The lesson highlights insightful commentary on cultural traditions.

2. 'Jagadish Chandra Bose' from The Great Indian Scientists.

Objective:

The lesson gives an account of the unique discoveries and inventions of Jagadish Chandra Bose in Science.

UNIT 5:

1. ' The Health Threats of Climate Change' from English Encounters.

Objective:

The essay presents several health disorders that spring out due to environmental changes

2. ' Prafulla Chandra Ray' from The Great Indian Scientists.

Objective:

The lesson given is an account of the experiments and discoveries in Pharmaceuticals of Prafulla Chandra Ray.

UNIT 6:

1. ' The Chief Software Architect' from English Encounters

Objective:

The lesson supports the developments of technology for the betterment of human life.

2. ' Srinivasa Ramanujan' from The Great Indian Scientists.

Objective:

The lesson highlights the extraordinary achievements of Srinivasa Ramanujan, a great mathematician and the most romantic figure in mathematics.

MATHEMATICS – III	L	T	P	C
	3	1	0	3
I Year II Semester	Subject Code: 16BH2T06			

Objective:

1. The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2. The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.
3. Understand the most basic numerical methods to solve simultaneous linear equations.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Find the Laplace transform of functions and evaluation of Integrals.	Understanding
CO2	Find the inverse Laplace transform of different functions and solve the differential equations using Laplace transform.	Applying
CO3	Tracing the curve for the given equation evaluate the double and triple integrals by direct method change of order of integration and change of variables.	Applying
CO4	Evaluate the given integrals by using Beta and Gamma functions.	Applying
CO5	Find the gradient of a scalar filed, divergence and curl of vector filed and vector identities.	Applying
CO6	Evaluate the line, surface and volume integrals. Solve the problems using vector integral theorems.	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	0	0	0	0	0	0	0	0	0	0	0
CO2	3	3	2	0	0	0	0	0	0	0	0	0	0	0
CO3	3	3	3	0	0	0	0	0	0	0	0	0	0	0
CO4	3	3	2	0	0	0	0	0	0	0	0	0	0	0
CO5	3	3	3	0	0	0	0	0	0	0	0	0	0	0
CO6	3	3	3	0	0	0	0	0	0	0	0	0	0	0

UNIT I: Laplace transforms

Laplace transforms of standard functions-Shifting theorems - Transforms of derivatives and integrals – Unit step function –Dirac's delta function.

UNIT II: Inverse Laplace transforms

Inverse Laplace transforms – Shifting Theorems - Transforms of derivatives and integrals - Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT III: Multiple integrals

Curve tracing: Cartesian, Polar and Parametric forms. Multiple integrals: Double and triple integrals – Change of variables – Change of order of integration.

Applications: Finding Areas and Volumes.

UNIT IV: Special functions

Beta and Gamma functions- Properties - Relation between Beta and Gamma functions -Evaluation of improper integrals.

Applications: Evaluation of integrals.

UNIT V: Vector Differentiation

Gradient- Divergence- Curl - Laplacian and second order operators -Vector identities.

Applications: Equation of continuity, potential surfaces

UNIT VI: Vector Integration

Line integral – Work done – Potential function – Area- Surface and volume integrals Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and related problems.

Applications: Workdone, Force.

Text Books:

1. **B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **N.P.Bali**, Engineering Mathematics, Lakshmi Publications.
3. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

Reference Books:

1. **Greenberg**, Advanced Engineering Mathematics, 2nd edition, Pearson edn

2. **Peter O'Neil**, Advanced Engineering Mathematics,7th edition, Cengage Learning.
3. **D.W. Jordan and T.Smith**, Mathematical Techniques, Oxford University Press.
4. **Srimanta Pal, SubodhC.Bhunia**, Engineering Mathematics, Oxford University Press.
5. **Dass H.K., RajnishVerma. Er.**, Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.

APPLIED CHEMISTRY	L	T	P	C
	3	1	0	3
I Year II Semester	Subject Code: 16BH2T12			

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	To have an understanding on the plastic materials and their suitable design for engineering applications.	Applying
CO2	To learn about various fuels and their calorific values for use in various industrial applications.	Analyzing
CO3	Create awareness on corrosion and its impacts and the causes and control of corrosion.	Creating
CO4	To create knowledge on nano materials, liquid crystals and super conductors and their applications to learn green chemistry and to identify the green technologies to be implemented in industry.	Understanding
CO5	To acquire knowledge on crystal structure, semiconductors, insulators for their effective applications.	Applying
CO6	To create awareness on non- conventional energy sources for effective utilization to minimize in the national wealth and environmental impacts.	Understanding

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	0	2	0	0	3	0	2	0	0	0	0	0	0	0
CO2	0	3	0	0	0	0	1	0	0	0	0	0	0	0
CO3	0	0	0	0	3	0	3	0	0	0	0	0	0	0
CO4	0	3	3	0	0	2	0	0	0	0	0	0	0	0
CO5	1	0	0	2	1	0	3	0	0	0	0	0	0	0
CO6	0	0	1	0	3	2	2	0	0	0	0	0	0	0

UNIT I: HIGH POLYMERS AND PLASTICS

Polymerization:- Definition- Types of Polymers -Mechanism of polymerization- Stereo regular

polymers- Methods of polymerization(emulsion and suspension)-Physical and Mechanical properties. Plastics as engineering materials: advantages and limitations- Thermoplastics and Thermosetting plastics Compounding and fabrication (Compression, Injection, Extrusion and Blown Techniques)- Preparation, properties and applications of polyethene, PVC, Bakelite Teflon, Poly methyl Methacrylate(PMMA) and polycarbonates

Elastomers :- Natural rubber- Disadvantages- Mastication - compounding and vulcanization - Synthetic rubbers : Buna S, Buna N, Thiokol and polyurethanes - Applications of elastomers. Composite materials & Fiber reinforced plastics - Biodegradable polymers - Conducting polymers.

Learning Objectives: Plastics are nowadays used in household appliances; They are also used as composites (FRP) in aerospace and automotive industries.

UNIT II: FUEL TECHNOLOGY

Fuels – Definition –Classification - Characteristics of a good fuel - Calorific value - HCV and LCV - Dulong's formula - Bomb calorimeter – Numerical problems - Coal -- Proximate and Ultimate analysis and their Significance - Liquid fuels - Petroleum- Origin and Refining - Cracking - Synthetic petrol -Petrol knocking - Diesel knocking - Octane and Cetane ratings - Anti-knock agents - Power alcohol – Bio diesel,

Gaseous fuels: - Natural gas, LPG and CNG, Combustion - Calculation of air for the combustion of a fuel, Flue gas analysis – Orsat's apparatus - Numerical problems on combustion

Explosives:- Rocket fuels

Learning Objectives: 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 are introduced to create awareness on the topics.

UNIT III: ELECTROCHEMICAL CELLS AND CORROSION

Galvanic cells - Reversible and irreversible cells - Single electrode potential - Electro chemical series and uses of this series- Standard electrodes (Hydrogen ,Calomel and Glass electrode) - Concentration Cells - Batteries: Dry Cell - Ni-Cd cells - Ni-Metal hydride cells - Li cells - Zinc - air cells.

Fuel cells:- Introduction - cell representation, H2-O2 fuel cell: Design and working, advantages and limitations. Types of fuel cells: Alkaline fuel cell - methanol-oxygen - phosphoric acid fuel cells - molten carbonate fuel cells.

Corrosion :- Definition - Theories of Corrosion (chemical & electrochemical) - Formation of galvanic cells by different metals, by concentration cells, by differential aeration and waterline corrosion – Passivity of metals -Pitting corrosion - Corrosion under insulation -Galvanic series - Factors which influence the rate of corrosion –Protection from corrosion -Design and material selection - Cathodic

protection - Protective coatings: - Surface preparation - Metallic (galvanizing and tinning) coatings - Methods of application on metals (Electroplating, Electro less plating),

Learning Objectives: The basics for the construction of galvanic cells are introduced to have understanding on the concepts. Understanding on the concept of Corrosion and Mechanism of Corrosion with Theories like Electrochemical theory.

UNIT IV: CHEMISTRY OF ADVANCED MATERIALS

Nano materials:- Introduction - Sol-gel method & chemical reduction method of preparation- Characterization by Braunear Emmett Teller(BET) method, Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM) methods - Carbon nano tubes : Types, preparation(Laser ablation and Chemical vapour deposition method), properties and applications, Fullerenes.

Liquid crystals:- Introduction - Types - Applications

Super conductors:-Type -I, Type II - Characteristics and applications

Green synthesis: - Principles of Green Chemistry - Methods of synthesis (Aqueous Phase Method, Super Critical Fluid Extraction and Phase Transfer Catalysis) with examples - R4M4 principles

Learning Objectives: 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 in Unit – IV

UNIT V: SOLID STATE CHEMISTRY

Types of solids - close packing of atoms and ions - BCC , CC, structures of rock salt cesium chloride-spinel - normal and inverse spinels, Non-elemental semiconducting Materials:- Stoichiometric, controlled valency & Chalcogen photo/semiconductors, Preparation of semiconductors - Semiconductor Devices:- p- n junction diode as rectifier - junction transistor. Insulators (electrical and electronic applications)

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

Learning Objectives: Understanding of crystal structures will help to understand the conductivity, semiconductors and superconductors. Magnetic properties are also studied to have better Understanding.

Outcomes: Conductance phenomenon can be better understood

UNIT VI: NON CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES

Solar Energy:- Introduction, application of solar energy, conversion of solar energy (Thermal conversion & photo conversion) - photovoltaic cell: design, working and its importance

Non-conventional energy sources

(i) Hydropower include setup a hydropower plant (schematic diagram)

(ii) Geothermal energy: Introduction-schematic diagram of a geothermal power plant

(iii) Tidal and wave power: Introduction- Design and working-movement of tides and their effect on sea level.

(iv) Ocean thermal energy: Introduction, closed-cycle, ocean thermal energy conversion (OTEC), open cycle OTEC, hybrid OTEC, schematic diagram and explanation.

(v) Biomass and bio fuels

Learning Objectives: With the increase in demand for power and also with depleting sources of fossil fuels, the demand for alternative sources of fuels is increasing. Some of the prospective fuel sources are introduced and the study can create a better understanding on the Non –Conventional Energy Sources and Storage Devices.

Text Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publicating Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.

Reference Books:

1.Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
2.Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.
3.A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest 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

COMPUTER PROGRAMMING USING C	L	T	P	C
	3	1	0	3
I Year II Semester	Subject Code: 16CS1T01			

Learning objectives:

Formulating algorithmic solutions to problems and implementing algorithms in C.

- Notion of Operation of a CPU, Notion of an algorithm and computational procedure, editing and executing programs in Linux.
- Understanding branching, iteration and data representation using arrays.
- Modular programming and recursive solution formulation.
- Understanding pointers and dynamic memory allocation.
- Understanding miscellaneous aspects of C.
- Comprehension of file operations.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Differentiate Procedural and Object-oriented languages.	Understanding
CO2	Use different data types, learn programming styles, and assignment variations in a C program.	Applying
CO3	Choose the loops and decision making statements to solve the problem.	Applying
CO4	Demonstrate the use of functions to solve the given problem.	Understanding
CO5	Implement different operations on arrays and use string functions.	Applying
CO6	Make use of pointers, structures and unions and also implement file operations in C programming for a given application.	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3	2	-	-	-	-	-	-	-	-	2	3
CO2	3	2	3	2	-	-	-	-	-	-	-	-	2	3
CO3	3	2	3	2	-	-	-	-	-	-	-	-	2	3
CO4	3	2	3	2	-	-	-	-	-	-	-	-	2	3
CO5	3	2	3	2	-	-	-	-	-	-	-	-	2	3
CO6	3	2	3	2	-	-	-	-	-	-	-	-	2	3

UNIT-I:

History and Hardware - Computer Hardware, Bits and Bytes, Components, Programming Languages - Machine Language, Assembly Language, Low- and High-Level Languages, Procedural and Object- Oriented Languages, Application and System Software, The Development of C Algorithms The Software Development Process.

UNIT-II:

Introduction to C Programming- Identifiers, The main () Function, The printf () Function P**rogramming Style** - Indentation, Comments, Data Types**,** Arithmetic Operations, Expression Types, Variables and Declarations, Negation, Operator Precedence and Associativity, Declaration Statements, Initialization.

Assignment - Implicit Type Conversions, Explicit Type Conversions (Casts), Assignment Variations, Mathematical Library Functions, Interactive Input, Formatted Output, Format Modifiers.

UNIT -III:

Control Flow-Relational Expressions - Logical Operators:

Selection: if-else Statement, nested if, examples, Multi-way selection: switch, else-if, examples.

Repetition: Basic Loop Structures, Pretest and Posttest Loops, Counter-Controlled and Condition-Controlled Loops, while Statement, for Statement, Nested Loops, do-while Statement.

UNIT-IV

Modular Programming: Function and Parameter Declarations, Returning a Value, Functions with Empty Parameter Lists, Variable Scope, Variable Storage Class, Local Variable Storage Classes, Global Variable Storage Classes, Pass by Reference, Passing Addresses to a Function, Storing Addresses, Using Addresses, Declaring and Using Pointers, Passing Addresses to a Function.

Case Study: Swapping Values, Recursion - Mathematical Recursion, Recursion versus Iteration.

UNIT-V:

Arrays & Strings

Arrays: One-Dimensional Arrays, Input and Output of Array Values, Array Initialization, Arrays as Function Arguments, Two-Dimensional Arrays, Larger Dimensional Arrays- Matrices.

Strings: String Fundamentals, String Input and Output, String Processing, Library Functions

UNIT-VI:

Pointers, Structures, Files

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

Structures: 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:

1. ANSI C Programming, Gary J. Bronson, Cengage Learning.
2. Programming in C, B. L.Juneja, Anita Seth, Cengage Delmar Learning India Pvt.
3. The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education.

Reference Books:

1. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage.
2. Programming with C, R S Bichkar, University Press, 2012.
3. Programming in C, ReemaThareja, Oxford.
4. C by Example, Noel Kalicharan, Cambridge University Press.

URLs

1. http://nptel.ac.in/courses/106104128/
2. http://students.iitk.ac.in/programmingclub/course/#notes
3. http://c-faq.com/~scs/cclass/cclass.html
4. http://www.youtube.com/watch?v=b00HsZvg-V0&feature=relmfu
5. http://ocw.mit.edu/courses/electrical-engineering-and-compute
6. science/6-087-practical- programming-in-c-january-iap-2010/

BASIC NETWORK THEORY	L	T	P	C
	3	1	0	3
I Year II Semester	Subject Code: **16EC2T01**			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Use network techniques, like node analysis and loop analysis, to write equations for large linear circuits.	Apply
CO2	Apply Thevenin and Norton theorems to analyze and design for maximum power transfer.	Analyze
CO3	Apply the concept of linearity and the associated technique of superposition to circuits and networks.	Apply
CO4	Apply phasor analysis to AC circuits in sinusoidal steady state.	Apply
CO5	Analyze the frequency response of circuits containing inductors and capacitors.	Analyze
CO6	Apply the Laplace transform to linear circuits and systems.	Apply

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	0	0	0	0	0	0	0	0	0	2	3
CO2	2	1	0	0	0	0	0	0	0	0	0	0	0	0
CO3	2	1	1	0	0	0	0	0	0	0	0	0	1	2
CO4	2	2	2	0	0	0	0	0	0	0	0	0	2	3
CO5	3	2	2	0	0	0	0	0	0	0	0	0	3	2
CO6	3	3	2	0	0	0	0	0	0	0	0	0	2	3

UNIT-I

Introduction to Electrical Circuits: Network elements classification, Electric charge and current, electric energy and potential, Resistance parameter-series and parallel combination, Inductance parameter series and parallel combination, Capacitance parameter-series and parallel combination. Energy sourcs: 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 (Text Books:1,2,3 Reference Books:3) A.C Fundamentals and Network Topology: Definitions of terms associated with periodic function : 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 example.

Network Topology: Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basic tie set schedule, basic cut set schedule. (Text Books:2,3, Reference Books:3)

UNIT-II

Steady State Analysis of A.C Circuits: 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 phasor notation for R-L, R-C,R-L-C problem solving using mesh and nodal analysis, Star –Delta conversion, problem solving (Text Books:1,2, Reference Books:3).

UNIT-III

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.

Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, condition for maximum impedance, current in anti resonance, Band width of parallel maximum impedance, current in anti resonance, Band width of parallel resonance, general case- resistance present in both branches, anti resonance at all frequencies. (Text Books 2,3, Reference Books:3).

UNIT-IV

Network Theorems: Thevinin's Norton's Milliman's Reciprocity, Compensation, Substitution, Superposition, Max Power Tranfer, Tellegens-problem solving using dependent sources also (Text Books:1,2,3 Reference Books:2).

UNIT-V

Two-port networks: Relationship of two port networks, Z-parametes, 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 (Text Books:1,2, Reference Books:1,3)

UNIT-VI

Transients: First order differential equations, Definition of time constant, 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 and AC excitation, Response as related to s-plane rotation of roots. Solution using Laplace transform method (Text Books:1,2,3, Reference Books:1,3).

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.
3. Network Analysis and Filter Design by Chadha, Umesh Publications.

APPLIED CHEMISTRY LAB	L	T	P	C
	0	0	3	2
I Year II Semester	Subject Code: 16BH2L05			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Students are able to estimate the impurities in water.	Evaluating
CO2	Ability to know the strength of an acid present in secondary batteries.	Understanding
CO3	Handling different types of instruments for analysis of materials using small quantities of materials involved for quick and accurate results.	Analyzing

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	0	3	0	3	0	0	0	0	2	3	2	0	0	3
CO2	0	3	0	0	0	0	0	0	1	2	0	0	0	1
CO3	1	2	0	1	0	0	1	0	0	0	0	0	0	0

1. Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis, Quantitative analysis etc.,
2. Trial experiment – Estimation of HCI using standard Na2co2 solutions
3. Estimation of KMnO4 using standard Oxalic acid solution.
4. Estimation of Ferric iron using standard K2Cr2O7 solution
5. Estimation of Copper using standard K2Cr2O7 solution.
6. Estimation of Total Hardness water using standard EDTA solution.
7. Estimation of Copper using standard EDTA solution.
8. Estimation of Copper using Colorimeter
9. Estimation of pH of the given sample solution using pH meter.

10. Conductometric Titrations between strong acid and strongbase
11. Conductometric Titrations between strong acid and Weakbase
12. Potentiometric Titrations between strong acid and strongbase
13. Potentiometric Titrations between strong acid and Weakbase
14. Estimating of Zinc using standard potassium ferrocyanide solution
15. Estimation of Vitamin – C

STANDARD BOOKS :

1. Dr.Jyotsna Cherukuis(2012)Laboratory Manual of Engineering Chemistry-II, VGS TechnoSeries
2. Chemistry Practical Manual, Lorven Publications
3. K. Mukkanti (2009) Practical Engineering Chemistry, B.S. Publication

ENGLISH - COMMUNICATION SKILLS LAB- II	L	T	P	C
	0	0	3	2
I Year II Semester	Subject Code: 16BH2L02			

PRESCRIBED LAB MANUAL FOR SEMESTER II:

'INTERACT: English Lab Manual for Undergraduate Students' Published by Orient Blackswan Pvt Ltd.

OBJECTIVES: To enable the students to learn demonstratively the communication skills of listening, speaking, reading and writing.

OUTCOME: A study of the communicative items in the laboratory will help the students become successful in the competitive world.

The course content along with the study material is divided into six units.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Make use of argumentative and critical thinking skills by elaborating ideas relevantly and improve team working skills.	Creating
CO2	Select and adopt appropriate non-verbal communication and other presentation required skills to deliver effective presentation with clarity and impact. And to develop fluency in communication and present themselves in interviews confidently.	Remembering
CO3	Analyze and compose the unique qualities of professional writing styles to meet the needs and demands in both academics and professions to demonstrate the harmony of language and avoiding mistakes.	Analyzing

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	0	0	0	0	0	0	1	0	3	3	0	0	0	0
CO2	0	0	0	0	0	0	1	0	2	3	0	0	0	0
CO3	0	0	0	0	0	0	0	0	2	3	0	0	0	0

UNIT-1:

1.Debating- Practice work

UNIT-2:

1. Group Discussion- Practice work

UNIT-3:

1. Presentation Skills- Practice work

UNIT-4:

1. Interview Skills- Practice work

UNIT-5:

1. Email
2. Curriculum Vitae- Practice work

UNIT-6:

1. Idiomatic Expressions
2. Common Errors in English- Practice work

Reference Books:

1. Strengthen your communication skills by Dr M Hari Prasad, Dr Salivendra Raju and Dr G Suvarna Lakshmi, Maruti Publications.
2. English for Professionals by Prof Eliah, B.S Publications, Hyderabad.
3. Unlock, Listening and speaking skills 2, Cambridge University Press
4. Spring Board to Success, Orient BlackSwan
5. A Practical Course in effective english speaking skills,PHI
6. Word power made handy, Dr shalini verma, Schand Company

C PROGRAMMING LAB	L	T	P	C
	0	0	3	2
I Year II Semester	Subject Code: 16BH2L01			

OBJECTIVES:

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

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Development of object oriented programming	Applying
CO2	Design of programs using data encapsulation, abstraction, Inheritance, Polymorphism and Exceptions Handling.	Applying
CO3	Demonstration of Templates	Applying

The Mapping of CO and PO on 3 point scale {high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	3	2	0	0	0	0	0	0	0	2	3
CO2	3	3	3	3	2	0	0	0	0	0	0	0	2	3
CO3	3	3	3	3	2	0	0	0	0	0	0	0	2	3

Programming

Exercise - 1 Basics

a) What is an OS Command, Familiarization of Editors - vi, Emacs

b) Using commands like mkdir, ls, cp, mv, cat, pwd, and man

c) Write a 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 vice versa

Exercise - 3 Control Flow - I

a) Write a C Program to Find Whether the Given Year is a Leap Year or not.
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 Number is
Prime Number
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 switch call function the function

Exercise – 7 Functions – Continued

Write a C Program to compute the values of sinx and cosx 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 on Matrix.

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 Continue

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

b) Write a C program to delete a file.

ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
	3	1	0	3
II Year I Semester	Subject Code: 16EC3T03			

Objective:

1. To learn the basics of semiconductor physics. Review of Semi Conductor Physics
2. To study the construction details, operation and characteristics of various Semiconductor diodes
3. To understand the operation and analysis of rectifiers with and without filters.
4. To study the characteristics of bipolar junction transistors in different configurations and characteristics of different types of FET
5. To understand the biasing stabilization and compensation techniques. To analyze transistor amplifiers using h-parameters.
6. To understand the concepts of transistor low frequency hybrid model and analysis of CE, CB and CC amplifiers.

Course Outcomes:

CO	COURSE OUTCOME	BTL
CO1	Students are able to apply the basic concept of semiconductor physics	Apply
CO2	Students are able to explain the operation and characteristics PN junction diode & special diodes	Understand
CO3	Ability to understand operation & design aspects of rectifiers& regulators	Understand
CO4	Students are able to understand the characteristics of various transistor configurations	Understand
CO5	Students became familiar with biasing ,stabilization and compensation technique used in transistor circuits	Analysis
CO6	Students are able to understand the CB,CE& CC amplifier with exact and approximate analysis	Analysis

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO-1	3	1	-	-	-	-	-	-	-	-	-	-	-	2
CO-2	1	-	-	2	-	-	-	-	-	-	-	1	1	3
CO-3	1	-	-	-	-	-	-	-	-	-	-	1	1	3
CO-4	1	-	-	2	-	-	-	-	-	-	-	1	1	3
CO-5	1	2	-	-	-	-	-	-	-	-	-	1	-	2
CO-6	2	1	-	-	-	-	-	-	-	-	-	-	-	2

Prerequisite: This course introduces the concepts of semi-conductor physics and operation of various semi-conductor devices. Realization of rectifiers, amplifiers using semi-conductor devices and their analysis is also introduced in this course

UNIT-I

Semi Conductor 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, charge densities in semiconductors, Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors.

UNIT-II

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, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance, energy band diagram of PN junction-Diode.

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, LED, LCD, LDR, Photo diode, Photo transistor, Varactor diode, Tunnel Diode, DIAC, TRIAC, SCR, UJT Construction, operation and characteristics of all the diodes is required to be considered.

UNIT-III

Unregulated Power Supplies: Introduction**,** half wave rectifier, full wave rectifier, bridge rectifier circuit diagrams operation, input and output waveforms, derivations of $I_{dc,}$ $I_{RMS,}$ efficiency, ripple factor, TUF, voltage regulation, Design of Zener voltage regulator.

Filters: Series Inductor filter, Shunt Capacitor filter, L- section filter, Π- section filter, Multiple L-section Filter, derivation for ripple factor in each case.

UNIT-IV

BJT& FET Characteristics:

BJT: Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations , Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values. 9

FET: FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

UNIT-V

Biasing Techniques 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 VBE, Ic, and β, Stability factors, (S, S', S''), Bias compensation, Thermal runaway, Thermal stability. FET Biasing- methods and stabilization.

UNIT-VI

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, CS and CD amplifiers, comparison of FET amplifiers.

TEXT BOOKS:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata McGraw Hill, Second Edition 1972.
2. Electronic Devices and Circuits- K. Satya Prasad, VGS publication 2006.
3. Electronic Devices and Circuits – A.P.Godse, U.A.Bakshi Technical Publications

REFERENCES:

1. Electronic Devices and Circuits -BV Rao, KBR Murty, K Raja Rajeswari, PCR Pantulu, Pearson, 2nd edition.

2. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, TataMc-Graw Hill, Second Edition .
3. Electronic Devices and Circuit Theory-R.L. Boylestad and LouisNashelsky, Pearson Publications, Tenth Edition.
4. Electronic Devices and Circuits-B.P.Singh, RekhaSingh,PearsonPublications,Second Edition.
5. Electronic Devices and Circuits-David A.Bell, Oxford University Press, Fifth Edition.

WEB LINKS:

1. http://nptel.ac.in/courses/117103063
2. www.satishkashayap.com/2013/03/video-lectures-on-electron-devices-by.html
3. http://www.smartzworld.com/notes/electronic-devices-and-circuits-edc/

CONTROL SYSTEMS	L	T	P	C
	3	1	0	3
II Year I Semester	Subject Code: 16EC3T04			

OBJECTIVES

1. The student will learn the fundamental concepts of Control systems and mathematical modeling of the system.
2. Learn the difference between open loop control system and closed loop control system
3. Learn the representation of various control systems transfer functions in the form of block diagrams and signal flow graphs and obtain a simplified transfer function
4. Understand the difference between transient response and steady state response
5. Study the time domain specifications and frequency domain specifications
6. Study the concepts of time response and frequency response of the system.
7. understand the stability of control systems from the s domain analysis and frequency response plot obtained

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Represent the mathematical model of a system and transfer function of mechanical & electrical systems.	Analyze
CO2	Determine the response of different servo motors and reduction techniques.	Understand
CO3	Analyze the stability of different systems.	Create
CO4	Understand the difference between transient response and steady state response.	Evaluate
CO5	Determine the frequency response of different order systems.	Analyze
CO6	Know the controllability and observability of control systems using state space techniques	Understand

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	2	1	-	-	-	-	-	-	-	-	2	2	2
CO-2	2	2	1	-	-	-	-	-	-	-	-	1	2	2
CO-3	3	2	1	--	-	-	-	-	-	-	-	2	2	2
CO-4	2	2	2	-	-	-	-	-	-	-	-	1	2	2
CO-5	2	2	2	-	-	-	-	-	-	-	-	2	2	2
CO-6	2	2	1	-	-	-	-	-	-	-	-	2	2	2

UNIT I

INTRODUCTION

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Types of feedback control systems-Linear time invariant, time variant systems and non linear control systems.

Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems

UNIT II

TRANSFER FUNCTION REPRESENTATION

Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra –Representation by Signal flow graph - Reduction using mason's gain formula.

UNIT III

TIME RESPONSE ANALYSIS

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

UNIT IV

STABILITY ANALYSIS IN S-DOMAIN

The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability.

Root Locus Technique: The root locus concept, construction of root loci, effects of adding poles and zeros to closed loop system.

UNIT V

Frequency Response Analysis: Introduction, Frequency domain specifications, Bode diagrams, Determination of Frequency domain specifications and transfer function from the Bode diagram, Phase margin and Gain margin, Stability analysis from Bode plots.

Stability Analysis in Frequency Domain: Polar plots, Nyquist plots, Stability analysis, closed loop frequency response.

UNIT VI

Classical Control Design Techniques: Compensation techniques, Lag, Lead, Lead-Lag Controllers design infrequency domain, PID Controllers. State space analysis of continuous systems concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization, Solving the Time invariant state equations, State transition matrix and it's properties, concepts of controllability and observability.

TEXT BOOKS:

1. Automatic Control Systems– B C Kuo, 8th edition, John wiley and son's,2003.

2. Control Systems Engineering – I JNagrath and M Gopal, 2nd edition, NewAge International (P) Limited Publishers,1982.

REFERENCE BOOKS:

1. Modern Control Engineering – Katsuhiko Ogata,3rd edition, Prentice Hall ofIndia Pvt. Ltd., 1998.

2. Control Systems – N K Sinha,3rd edition, New Age International (P) LimitedPublishers, 1998.

3. Control Systems – A NagoorKani, 2nd edition, RBA Publications.

Web links:

1. **nptel.ac.in/course/108101037/#**
2. http://ocw.mit.edu/resources/res-6-010
3. www.learnersto.com/free-engineering-video-lectures-1to330

SIGNALS AND SYSTEMS	L	T	P	C
	3	1	0	3
II Year I Semester	Subject Code: 16EC3T05			

PREREQUISITES: Courses on Engineering Mathematics and Mathematical Methods**.**

Objective:

1. Analysis of signals and systems
2. Representation of signals using Fourier series and Fourier transform and their properties
3. Time - Domain and Frequency Domain aspects of signals and systems
4. Concept of convolution and correlation;
5. Laplace transform of signals;
6. Z-Transform of sequences and their properties.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Demonstrate fundamental knowledge in Trigonometric and exponential FS representation of periodic signals	Applying
CO2	Demonstrate fundamental knowledge in Fourier transform of signals, sampling process	Applying
CO3	Demonstrate fundamental knowledge in linear systems, properties, various filters, and their characteristics	Analyzing
CO4	Demonstrate fundamental knowledge in convolution and correlation of functions	Applying
CO5	Demonstrate fundamental knowledge in Laplace transorms,ROC	Applying
CO6	Demonstrate fundamental knowledge in z-transforms for discrete sequences, ROC	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3		1	2								2	2	1
CO2	2	1	2	1									1	2	1
CO3	3	2	1	1									2	1	1
CO4	3	2	2	1	2								1	2	2
CO5	3	2	2	1	2								3	2	2
CO6	1	1	3	3	3	2	3	3	3	3	3	3	3	3	3

UNIT-I

Signal Analysis & Fourier series: Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions, Orthogonality in complex functions.

Elementary signals: Unit Impulse, Unit Step Functions, Exponential and Sinusoidal Signals. Classification of Continuous Time and Discrete Time Signals, Basic operations on signals, Classification of Continuous Time and Discrete Time Systems, Basic System Properties, Linear Time-Invariant Systems, Discrete Time LTI Systems.

Fourier Series: Representation of Fourier series, Continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum, Fourier series representation of periodic signals using symmetry, Relation between Trigonometric Fourier series and Complex Fourier series .

UNIT-II

Fourier Transforms and Sampling: Deriving Fourier transform from Fourier series, Fourier transform of impulse, step, ramp, Signum, exponential signals, aperiodic and periodic signals. Properties of Fourier transform, Introduction to Hilbert Transform.

Sampling: Representation of a Continuous time signal by its samples, Sampling theorem, reconstruction of a signal from its samples, different sampling techniques, Effect of under sampling: aliasing.

UNIT III

Signal Transmission through Linear Systems: Linear system, impulse response, Response of a linear system, Linear Time Invariant (LTI) system, Linear Time Variant (LTV) system, Transfer function 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, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time.

UNIT-IV

Convolution & Correlation of Signals: Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property of Fourier transforms. Cross correlation and auto correlation of functions, properties of correlation function, 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, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering, Problem Solving.

UNIT-V

Laplace Transforms: Laplace transform of impulse, step, ramp, Signum, exponential signals, aperiodic and periodic signals. Region of Convergence for Laplace transforms, Inverse Laplace transform, relation between Fourier and Laplace transform, Properties of the Laplace transform, Laplace transform and ROC for various classes of signals, Problem Solving.

UNIT-VI

Z-Transforms: Z-transform of discrete impulse, step, ramp, Signum, exponential signals. Region of Convergence for the Z-transform, The Inverse Z-transform, relation between Fourier and Z-transform, Properties of the Z-transform, Z-transform and ROC for various classes of signals.

TEXT BOOKS :

1. Signals, Systems & Communications – B P Lathi, 2nd edition, BS Publications,2003.
2. Signals and Systems – A V Oppenheim, ASWillsky and S H Nawab, 2nd edition, PHI,1997.
3. Signals and Systems – Narayan Iyer and K SatyaPrasad,1st edition, Cenage Publications,2011.

REFERENCES :

1. Signals & Systems - Simon Haykin and Van Veen,2nd edition,Wiley Publications, 1999.
2. Signals & Systems - A Anand Kumar, 2nd edition, PHI, 2011.
3. Signals & Systems - K R Rajeswari and B V Rao,2nd edition, PHI, 2014.
4. Fundamentals of Signals and Systems - Michel J Robert, MGH International Edition, 2008.

WEB LINKS:

1. www.nptelvideos.in/2012/12/signals-and-systems.html
2. Freevideolectures.com
3. www.satishkashyap.com

NETWORK ANALYSIS AND SYNTHESIS	L	T	P	C
	3	1	0	3
II Year I Semester	Subject Code: 16EC3T06			

Course Objectives:

1. One can solve the problem using algebraic equations in Laplace form instead of using integration & differentiations.
2. One can understand the difference between conductively coupled & mutual coupled currents and can find out the input impedance using equivalent conductively coupled circuits.
3. By doing series & Parallel resonance circuits one can know about tuned circuits.
4. One can gain thorough knowledge on different circuit parameters & later they can be used for system design.
5. Steady state analysis of AC circuits will give clear concept about different values like RMS, form factor, Peak factor, etc. hence one can able to find out steady state branch currents, branch voltages & powers.
6. By doing passive synthesis one can design their own circuit by knowing response and excitation.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Able to design complicated circuits with complex quantities by using Laplace transforms	Applying
CO2	Can design transformers with the help of mutually coupled circuits	Applying
CO3	In communications systems we can design series / Parallel tuned circuits	Applying
CO4	For system design we can make use of h-Parameters and can find out output quantities like current gain, voltage gain, etc	Understanding
CO5	Can be able to analyze commercial available power & can detect the false also	Analyzing
CO6	One can able to design different circuits using mixed canonic forms by knowing excitation and response	Understanding

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	2	1	-	-	-	-	-	-	-	-	-	2	1
CO-2	2	2	1	-	-	-	-	-	-	-	-	-	2	1
CO-3	2	2	1	-	-	-	-	-	-	-	-	-	2	1
CO-4	2	2	1	-	-	-	-	-	-	-	-	-	2	1
CO-5	2	2	1	-	-	-	-	-	-	-	-	-	2	1
CO-6	2	2	1	-	-	-	-	-	-	-	-	-	2	1

UNIT I

Laplace Transforms: Introduction to Laplace transforms, Basic theorems for Laplace transforms, Laplace transforms of shifted unit step, ramp and impulse functions. Examples of finding response using Laplace transforms, Wave form synthesis, initial & final value theorems, convolution integral.

UNIT II

Resonance: Definition of Q-factor, series resonance introduction, band width of series resonance circuits, anti resonance circuits, condition for maximum impedance, Bandwidth of anti resonance circuit, resonance present in both branches, anti resonance at all frequencies.

Coupled circuits: Mutual Inductance – introduction, definitions of self inductance, mutual inductance, relation between self & mutual inductance, coefficient of coupling, analysis of coupled circuits, dot rule for coupled circuits, conductively coupled equivalent circuits, problem solving using dot method.

UNIT III

Two port networks: Introduction to two-port networks, open circuit impedance parameters , short circuit admittance parameters, hybrid parameters, ABCD parameters, relation between different parameters, cascading of two-port networks, parallel connection of two-port networks, series connection of two-port networks, problem solving including dependent sources, condition of symmetry and reciprocity.

UNIT IV

Network functions: Poles, Zeros, Impedance and transform circuits – resistance, inductance, capacitance, series & parallel combination of elements, determination of input impedance, problem solving with initial conditions, network functions for one-port, two-port networks, ladder network, pole & zeros of network functions, necessary conditions for driving point functions,

necessary conditions for transfer functions, problem solving to determine current transfer ratio, input impedance, output impedance, etc…

UNIT V

AC Steady State Analysis: Characteristics of periodic functions, average value, RMS value, form factor, peak factor, representation of sine functions in trigonometric & phasor notations, impedance concept of R,L,C elements, steady state response of RLC circuits for sinusoidal excitation using impedance concept by applying mesh & nodal analysis.

UNIT VI

Introduction to Network Synthesis: Properties of driving point LC, RC, RL, impedance and admittance functions. Driving Point synthesis of LC, RC and RL functions – foster 1, foster 2, Couer 1, Couer 2 forms.

Text Books:

1. Network analysis – M E Van Valkenburg, 3rd edition, Reprint, Pearson Publications, 2002.
2. Engineering Circuit Analysis – W H Hayt& J E Kemmerly,1st edition, McGrawHill Publications,1971.
3. Introduction to Modern Network Synthesis – M E Van Valkenburg, 2nd edition,John Willey & Sons, 1962.

Reference Books:

1. Network Analysis - NCJagan, C Lakshmi Narayana, 2nd edition, BS publications, 2009.
2. Engineering Network Analysis & Filter Design - PremRChadha,1st edition, Umesh Publications, 1999.
3. Electric Circuits – Joseph A.Edminister, 1st edition, Schaum's outline series, 1965.

Web Links:

1. http://nptelacin/courses/108102042/
2. http://freevideolecturescom/Course/2336/Circuit-Theory/6
3. http://freevideolecturescom/Course/2350/Networks-Signals-and-Systems/14
4. http://npteliitgernetin/courses/Elec_Engg/IIT%20Delhi/Circuit%20Theory%20(Video)htm

SWITCHING THEORY AND LOGIC DESIGN	L	T	P	C
	3	1	0	3
II Year I Semester	Subject Code: 16EC3T07			

Course Objectives:

1. To solve a typical number base conversion and analyze new error coding techniques.
2. Theorems and functions of Boolean algebra and behavior of logic gates.
3. To optimize logic gates for digital circuits using various techniques.
4. Boolean function simplification using Karnaugh maps and Quine-Mc Cluskey methods.
5. To understand concepts of combinational circuits.
6. To develop advanced sequential circuits.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Classify different number systems and apply to generate various codes	Applying
CO2	Use the concept of Boolean algebra in minimization of switching functions	Analyzing
CO3	Design different types of combinational logic circuits	Understanding
CO4	Realization of switching functions by using the concepts of PLDs	Analyzing
CO5	Apply knowledge of flip-flops in designing of Registers and counters	Analyzing
CO6	The operation and design methodology for synchronous sequential circuits and algorithmic state machines	Understanding

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	2	1	2	-	-	-	-	-	-	-	-	2	2
CO-2	2	3	1	2	-	-	-	-	-	-	-	-	1	1
CO-3	2	3	1	3	-	-	-	-	-	-	-	-	1	1
CO-4	2	3	1	2	-	-	-	-	-	-	-	-	2	2
CO-5	2	3	1	1	-	-	-	-	-	-	-	-	2	2
CO-6	2	2	1	2	-	-	-	-	-	-	-	-	2	1

UNIT I

Review of Number Systems: Representation of numbers of different radix, conversion of numbers from one radix to another radix, r-1's complement and r's complement of unsigned numbers subtraction, problem solving. Signed binary numbers - different forms, problem solving. 4-bit codes: weighted and non-weighted codes such as BCD, EXCESS-3, alphanumeric codes, 9's complement, 2 4 2 1, 5 4 -2 -1,

Logic Operations, Error Detection and Correction Codes: Basic logic operations - NOT, OR,AND, Boolean theorems, Complement and dual of logical expressions, NAND and NOR Gates, EX-OR, EX-NOR Gates, standard SOP and POS, Minimization of logic functions using theorems, Generation of self dual functions. Gray code, error detection and error correction code - parity checking - even parity, odd parity, Hamming code, multi level AND-NOR Realizations. Two level NAND-NAND and NOR-NOR realizations. Degenerative forms and Regenerative forms, multi level realizations.

UNIT II

Minimization of Switching Functions: Minimization of switching functions using K-Map up to 6-variables, Tabular minimization up to 5-variables, minimal SOP and POS Realization. Designing of code convertors using K-map etc.

UNIT III

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

Combinational Logic Circuits-II: Design of decoder, Demultiplexer, higher order demultiplexing, encoder, multiplexer, higher order multiplexer, realization of Boolean functions using decoders and multiplexers, priority encoder, different code converters using full adders,4-bit comparator.

UNIT IV

Programmable Logic Devices(PLDs): PROM,PLA,PAL, Programming tables of PROM, PLA and PAL, realization of switching functions using PROM, PLA and PAL, comparison of PROM,PLA, and PAL.

UNIT V

Sequential Circuits-I: Classification of sequential circuits (synchronous and asynchronous): basic flip-flops, truth tables and excitation tables (RS latch usingNAND and NOR gates), RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals, functional tables, level

mode, negative edge trigging & master – slave flip-flops. Race condition, race around condition, setup time, hold time & propagation delay time of various flip-flops, Conversion of one flip-flop to other flip-flop. Calculation of clock frequency for Counters & Registers, State diagram of counters, Design of modulo counters - up/down counters, ripple counters, synchronous counters, Johnson counters, ring counters. Design of registers -buffer, control buffer, shift, bi-directional shift,universal shift registers.

UNIT VI

Sequential Circuits-II: Capabilities and limitations of Finite state machines, procedures & number of steps involved in analysis of clocked sequential circuits.

Design Procedures: Reduction of state tables by inspection, using partition method, equivalent classes for state assignment. Realization of circuits using various flip-flops. Meelay to Moore conversion and vice-versa.

TEXTBOOKS:

1. Switching theory and logic design - Hill and Peterson, Mc-Graw Hill edition.
2. Switching theory and logic design by - Kohavi.

Reference Books:

1. Switching Theory and Logic Design by A. Ananda Kumar
2. Digital design by Mano 2nd edition PHI.
3. Micro electronics by Millman MH edition.
4. Fundamentals of Logic Design by Charles H.RothJr, Jaico Publishers.

Web Links:

1. https://www.youtube.com/watch?v=CeD2L6KbtVM
2. Lecture series on Digital Circuits & Systems by Prof.S.Srinivasan, Department of Electrical Engineering, IIT Madras.For more details on NPTEL visit http://nptel.iitm.ac.in
3. https://www.youtube.com/watch?v=K73N9ES_8nI
4. https://www.youtube.com/watch?v=62WxkICo2Bc

MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS	L	T	P	C
	3	1	0	3
II Year I Semester	Subject Code: 16BH3T14			

Learning objectives:

1. To understand the concept and nature of Managerial Economic s and its relationship with other disciplines, Concept of Demand and Demand forecasting.

2. To understand the concept of Production function, Input Output relationship, different Cost Concepts and Concept of Cost-Volume-Profit Analysis.

3. To understand the Nature of Competition, Characteristics of Pricing in the different market structure and significance of various pricing methods.

4. To know the different forms of Business organization and their Merits and Demerits both public & private Enterprises and the concepts of Business Cycles.

5. To understand the different Accounting Systems preparation of Financial Statements.

6. To understand the concept of Capital, Capitalization, and Capital Budgeting and to know the techniques used to evaluate Capital Budgeting proposals by using different methods and uses of different tools for performance evaluation.

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Make use of the concepts of managerial economics and demand in managerial decision making and predicting demand for goods and services	Applying
CO2	Assess the functional relation among production, cost of production, cost concepts and Break Even Analysis	Evaluating
CO3	Classify market structures as perfect and imperfect markets for price and output decisions	Analyzing
CO4	Appraise the forms of business organizations and trade cycles in economic growth	Evaluating
CO5	Apply accounting principles in recording transactions for the purpose of preparing financial statements	Applying
CO6	Adapt capital budgeting techniques to take capital budgeting decisions.	Evaluating

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	0	3	0	0	0	0	0	0	0	0	0	0	0	0
CO-2	0	3	0	0	0	0	0	0	0	0	3	0	0	0
CO-3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
CO-4	0	0	0	0	0	0	0	0	0	0	0	3	0	0
CO-5	0	0	0	0	0	0	0	0	0	0	3	0	0	0
CO-6	0	3	0	0	0	0	0	0	0	0	3	0	0	0

Unit I

(*The Learning objective of this Unit is to understand the concept and nature of Management, Evolution of Management theories, Motivation and leadership Styles).

Introduction to Management: Concept –nature and importance of Management – Functions of Management – Evaluation of Management thought- Theories of Motivation – Decision making process-Designing organization structure- Principles of organization - Types of organization structure.

Unit II

(The Learning objective of this Unit is to Equip with the concepts of Operations management and inventory control).

Operations Management: production management-functions of production management– Work study- Statistical Quality Control- Control charts (P-chart, R-chart, and C-chart). Simple problems- **Material Management:** Need for Inventory control- EOQ, ABC analysis (simple problems) and Types of ABC analysis (HML, SDE, VED, and FSN analysis).

Unit III

(* The Objective of this unit is to understand the main functional area of organization i.e., financial management, Marketing Management, Human Resource Management, and Product Lifecycles).

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-financial management-functions of financial management.

Unit IV

(The Learning objective of this Unit is to Equip with the concepts of project management)

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

Unit V

(*The objective of this unit is to equip with the concept and practical issues relating to Strategic Management)

Entrepreneurship Management & Strategic Management: Entrepreneurship features-Financial Institutions facilitating entrepreneurship. Strategic Management: Vision, Mission, Goals, Strategy – Elements of Corporate Planning Process – Environmental Scanning – SWOT analysis Steps in Strategy Formulation and Implementation, Generic Strategy alternatives.

Unit VI

(*The Learning objective of this unit is to equip with the contemporary management practices, i.e., MIS, MRP, JIT and ERP etc.,).

Contemporary Management Practice: Basic concepts of MIS, MRP, Justin-Time (JIT) system, Total Quality Management (TQM), Six sigma and Capability Maturity Model (CMM) Levies, Supply Chain Management, Enterprise Resource Planning (ERP), Business Process outsourcing (BPO), Business process Re-engineering and Bench Marking, Balanced Score Card.

Text Books

1. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Management Science' Cengage, Delhi, 2012.
2. Dr. A. R. Aryasri, Management Science' TMH 2011.

REFERENCES

1. Koontz &Weihrich: 'Essentials of Management' TMH 2011
2. Seth &Rastogi: Global Management Systems, Cengage Learning, Delhi, 2011.
3. Robbins: Organizational Behaviors, Pearson Publications, 2011
4. KanishkaBedi: Production & Operational Management, Oxford Publications, 2011.
5. Manjunath: Management Science, Pearson Publications, 2013.
6. BiswajitPatnaik: Human Resource Management, PHI, 2011.
7. Hitt and Vijaya Kumar: Strategic Management, Cengage Learning.
8. Dr. PG. Ramanujam, BVR Naidu, PV Rama Sastry : Management Science Himalaya Publishing House, 2013.
9. Management Shapers, Universities Press.
10. Philip Kotler& Armstrong: Principles of Marketing, Pearson publications.
11. Principles of management and administration, D. Chandra Bose, Prentice
12. Hall of India Pvt. Ltd. New Delhi.
13. Patterns of Entrepreneurship Management, jack M.kaplan.

ELECTRONIC DEVICES AND CIRCUITS LAB	L	T	P	C
			3	2
II Year I Semester	Subject Code: 16EC3L01			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Experimental characteristics of PN junction diode, Zener, BJT, FET, SCR and UJT	Applying
CO2	Calculate Ripple factor & Efficiency for rectifier with filters and without filters	Applying
CO3	Calculate the Gain of BJT-CE, CC and FET Amplifiers & Operate electronic test equipment	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	-	-	-	-	-	-	-	1	-	-	-	1	1
CO2	1	1	-	-	-	-	-	-	1	-	-	-	2	1
CO3	1	1	-	-	-	-	-	-	1	-	-	-	1	1

PART A: Electronic Workshop Practice

1. Identification, Specifications, Testing of R, L, C Components (Colour 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 Multimeter, Function Generator, Regulated Power Supply
and CRO.

PART B: List of Experiments

(For Laboratory Examination-Minimum of Ten Experiments)

1. P-N Junction Diode Characteristics

Part A: Forward bias

Part B:Reverse bias

2. Zener Diode Characteristics

Part A: V-I Characteristics

Part B: Zener Diode as Voltage Regulator

3. BJT Characteristics (CE Configuration)

Part A: Input Characteristics

Part B: Output Characteristics

4. FET Characteristics (CS Configuration)

Part A: Drain Characteristics

Part B: Transfer Characteristics

5. SCR Characteristics

6. UJT Characteristics

7. Rectifiers (without and with c-filter)

Part A: Half-wave Rectifier

Part B: Full-wave Rectifier

8. CRO Operation and its Measurements

9. BJT-CE Amplifier

10. Emitter Follower-CC Amplifier

11. FET-CS Amplifier

PART C: Equipment required for Laboratory

1. Boxes

2. Ammeters (Analog or Digital)

3. Voltmeters (Analog or Digital)

4. Active & Passive Electronic Components

5. Regulated Power supplies

6. Analog/Digital Storage Oscilloscopes

7. Analog/Digital Function Generators

8. Digital Multimeters

9. Decade Résistance Boxes/Rheostats

10. Decade Capacitance

NETWORKS & ELECTRICAL TECHNOLOGY LAB	L	T	P	C
	3	1	0	3
II Year I Semester	Subject Code: 16EE3L02			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Understand the fundamental applications of the Resonance circuits and Time response of first order RC/RL network for periodic non-sinusoidal input.	APPLY
CO2	Understand the applications of design of Two port network parameters	APPLY
CO3	Understand the applications and able to design the network thermos	APPLY

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	2	-	-	-	-	-	-	-	-	-	3	2
CO2	3	1	2	-	1	-	-	-	-	-	-	-	3	2
CO3	3	1	2	-	1	-	-	-	-	-	-	-	3	2

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. Determination of 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

1. Magnetization characteristics of D.C. Shunt generator. Determination of critical field resistance.
2. Swinburne's Test on DC shunt machine (Predetermination of efficiency of a given DC Shunt machine working as motor and generator).
3. Brake test on DC shunt motor. Determination of performance characteristics.
4. OC & SC tests on Single-phase transformer (Predetermination of efficiency and regulation at given power factors and determination of equivalent circuit).
5. Brake test on 3-phase Induction motor (performance characteristics).
6. Regulation of alternator by synchronous impedance method.

ELECTRONIC CIRCUIT ANALYSIS	L	T	P	C
	3	1	0	3
II Year II Semester	Subject Code: 16EC4T09			

Course objectives:

1. Analyze a single stage amplifiers at high frequencies using transistors and FETs
2. Analyze multistage amplifiers using transistors and FETs
3. Design feedback amplifiers for different applications
4. Design sinusoidal Oscillators for a specified frequency
5. Design power amplifier for different applications
6. Apply tuned amplifiers for communication systems

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Students get explores variation of hybrid-π parameters with voltage, current and temperature ,frequency response	Understand
CO2	Frequency response of multistage CE,CB &JFET amplifier& its gain at low & high frequency .	analyze
CO3	Students gain an idea of feedback amplifier	apply
CO4	Students gain an idea of oscillators	apply
CO5	Students get explore of the concept of power amplifier	analyze
CO6	Students gain knowledge on tuned amplifiers, single tuned double & staggered tuned amplifier	apply

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO -1	3	1	2	-	-	-	-	-	-	-	-	-	3	1
CO -2	3	1	2	-	-	-	-	-	-	-	-	-	2	1
CO -3	3	1	3	-	-	-	-	-	-	-	-	-	3	2
CO -4	3	1	3	-	-	-	-	-	-	-	-	-	3	2
CO -5	3	1	3	-	-	-	-	-	-	-	-	-	3	2
CO -6	3	1	2	-	-	-	-	-	-	-	-	-	3	1

UNIT I

Small Signal High Frequency Transistor Amplifier Models:

BJT: Transistor at High Frequencies, Hybrid Common Emitter transistor model, Hybrid π conductance, Hybrid π capacitances, Validity of hybrid π model, determination of High frequency parameters in terms of low frequency parameters, CE short circuit gain, Current gain with resistive load, Cut-off frequencies, frequency response and gain bandwidth product.

FET: Analysis of Common Source amplifier and Common Drain Amplifier circuits at high frequencies.

UNIT II

Multistage Amplifier: Classification of amplifiers, methods of coupling, cascaded transistor amplifier and its analysis, two stage RC coupled amplifier analysis, High input Resistance Transistor, amplifier circuit and their analysis, Darlington pair amplifier, cascode amplifier, Miller's and dual of Miller's theorem, Boot strap emitter follower, analysis of multi stage amplifiers using FET, Differential amplifier using BJT.

UNIT III

Feedback Amplifier: Feedback Principle and concept, types of feedback, feedback topologies, classification of feedback amplifiers, characteristics of negative feedback amplifier, generalized analysis of feedback amplifier, performance comparison of feedback amplifiers, method of analysis of feedback amplifiers.

Unit IV

Oscillators: Oscillator principle, conditions for oscillations, types of oscillators – RC phase shift, Wein bridge, generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators using BJT and FET, Crystal oscillators, Frequency and amplitude stability of oscillators.

UNIT V

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 amplifiers, Thermal stability and use of Heat sinks, advanced power amplifiers, distortion in amplifiers.

Unit VI

Tuned Amplifiers: Introduction, Q- factor, Small Signal tuned amplifier, Capacitance Coupled Single tuned amplifier, Double tuned amplifiers, effect of cascading single tuned, double tuned amplifiers on band width, stagger tuned amplifiers, stability of tuned amplifiers, wideband amplifiers.

Text Books:

1. Integrated Electronics – J Millman and CCHalkias, Tata McGraw-Hill, 1972.
2. Electronic Devices and Circuit Theory – Robert L Boylestad and Louis Nashelsky, 10th edition Pearson Publications.
3. Electronic Circuit Analysis –Salivahanan, N Suresh Kumar, A Vallavaraj, 1stEdition, McGraw Hill, 2012.

REFERENCES:

1. Microelectronic Circuits – Sedra A S and K C Smith, 6th edition, Oxford University Press.
2. Electronic Circuit Analysis and Design – Donald A Neaman, McGraw Hill.
3. Electronic Circuits-I – Ravish R Singh,1st Edition 2012, Pearson Publications.
4. Electronic Circuit Principles and Application – R D SSamuel, BSujatha, Elesevier Publications.

WEB LINKS:

1. nptel.ac.in/courses/117101106
2. http://www.jntubook.com/electronics-circuit-analysis-textnbook-free-download/
3. www.freebookcentre.net/electronic-circuit-analysis

RANDOM VARIABLES AND STOCHASTIC PROCESS	L	T	P	C
	3	1	0	3
II Year II Semester	Subject Code: 16EC4T10			

Course Objectives: By studying this course the student will learn

1. the basic concepts of probability, theorems along with mathematical salvation
2. type of operations that can be performed with random variables
3. two random variables, characterization of joint density and distribution functions
4. Introduction of time axis to the Random Variable
5. Frequency domain representation of RV
6. Responses is studied in terms of convolution,mean,mean squared values

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Understand basic concepts of random variables used in communication system.	Understanding
CO2	Solve the calculation of mean and skew for single random variable.	Solving
CO3	Apply the calculation of average values for two random variables	Applying
CO4	Analysis of time domain representation of random Process	Analyze
CO5	Analysis of frequency domain representation of random Process	Analyze
CO6	Study of different noises and its modeling.	Understanding

The Mapping of CO and PO on 3 point scale {high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	2	2	-	-	-	-	-	-	-	-	-	2	1
CO-2	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO-3	3	2	2	--	-	-	-	-	-	-	-	-	2	1
CO-4	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO-5	2	2	2	-	-	-	-	-	-	-	-	-	2	1
CO-6	2	2	2	-	-	-	-	-	-	-	-	-	2	2

UNIT I

PROBABILITY: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and

Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, and Independent Events

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

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, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non monotonic Transformations of Continuous Random Variable

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: Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables,Linear Transformations of Gaussian Random Variables.

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, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

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.

UNIT VI

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 Spectrums of Input and Output, Band pass, Band-Limited and Narrowband Processes, Properties, Modeling of Noise Sources: Resistive (Thermal) Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Average Noise Figures, Average Noise Figure of cascaded networks.

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.
3. Probability Theory and Stochastic Process- Y.Mallikarjuna Reddy,University Press ,4th Edition
4. Probability, Statistics and Random Processes – K.Murugesan and P.Gurusamy

REFERENCES :

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

Web Links :

1. Nptel.ac.in/courses/117105085
2. www.youtube.com/playlist?list=PL46B9EA2CFEB51241
3. Nptel.ac.in/courses/1171030671
4. https://www.ma.utexas.edu/users/mks/m358kinstr/randomvariables.pdf
5. https://www.sufaribooksonline.com/...probability-randomvariables/9781118393956

ELECTROMAGNETIC WAVES AND TRANSMISSION LINES	L	T	P	C
	3	1	0	3
II Year II Semester	Subject Code: 16EC4T11			

Course Objectives:

1. To introduce the student to the theory and concepts of static electric and magnetic fields.
2. To study the Maxwell's Equations in Different Final Form and boundary conditions: Dielectric-Dielectric and Dielectric-Conductor Interfaces.
3. To study the electromagnetic waves Conducting and Perfect Dielectric Media, Wave Propagation.
4. To study the propagation, reflection, and transmission of plane waves, Poynting Vector and Poynting Theorem.
5. To study the Transmission Line Equations, Loading, Distortion in transmission lines.
6. To study the λ/4, λ /2, λ/8 Lines and their Impedance Transformations, to study waveguides,

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Depth analysis of the and physical interpretation of Maxwel's equation in static electric and magnetics	**Analysis**
CO2	Depth analysis of the field components and conditions at boundary surface	**Analysis**
CO3	Ability to Write the constitutive relation and solve wave equations in both isotropic and anisotropic media.	**Apply**
CO4	Ability to design devices using reflective and transmissive properties of dielectric and conductive materials	**Apply**
CO5	Depth analysis of transmission lines and their parameters and low loss and lossless transmission line characteristics	**Analysis**
CO6	Ability to Study the use of smith chart and its applications for different transmission lines.	**Apply**

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO-2	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO-3	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO-4	2	2	1	-	-	-	-	-	-	-	-	-	2	2
CO-5	2	2	1	-	-	-	-	-	-	-	-	-	2	2
CO-6	2	2	1	-	-	-	-	-	-	-	-	-	2	2

UNIT I

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, Spherical Capacitors, Illustrative Problems.

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.

UNIT II

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.

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 Lossless and Conducting Media. Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics.Polarization.Illustrative Problems.

UNIT IV

EM Wave Characteristics – II: 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, Surface Impedance. Poynting Vector and Poynting Theorem – Applications, Power Loss in a Plane Conductor.Illustrative Problems.

UNIT V

Transmission Lines - I : Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Losslessness/Low Loss Characterization, Distortion – Condition for Distortion less ness and Minimum Attenuation, Loading - Types of Loading. Illustrative Problems.

UNIT VI

Transmission Lines – II : Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. UHF Lines as Circuit Elements; λ/4, λ /2, λ/8 Lines – Impedance Transformations. Smith Chart – Configuration and Applications, Single and Double Stub Matching. Illustrative Problems.

Wave Guides: Introduction to wave guides, types of wave guides, field equations of rectangular and circular waveguides- modes (TE, TM, TEM) (Qualitative analysis only)

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.

3. Electromagnetic Waves and Transmission Line—Y. Mallikarjuna Reddy , Universities Press,2015

REFERENCES:

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

2. Engineering Electromagnetics – Nathan Ida, Springer (India) Pvt. Ltd., New Delhi, 2nd ed., 2005.

3. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, TMH, 7th ed., 2006.

4. Transmission Lines and Networks – Umesh Sinha, Satya Prakashan (Tech. India Publications), New Delhi, 2001.

5. Electromagnetics - John D.Kraus, , McGraw Hill Book Co., 1973.

WEB LINKS:

1. www.onlinecoursesnptel.ac.in
2. http://www.nptelvideos.in/2012/12/transmissions-lines-and-em-waves-html
3. http://freevideo lectures.com/course/2340/electromagnet-fields
4. http://cas.web.cerm.ch/cas/

ANALOG COMMUNICATIONS	L	T	P	C
	3	1	0	3
II Year II Semester	Subject Code: 16EC4T12			

Course Objectives:

The students will learn

1. To know the basics of Analog Communication
2. To extend the modulation techniques for better communication.
3. To know the concepts of Frequency Modulation
4. To study various effects of noise on Communication Systems.
5. To study the transmitting & receiving phenomenon by using different receivers & transmitters types,
6. To study about different Pulse Modulation techniques.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Understand the operation of AM & its representation in time domain & Frequency domain.	Understand
CO2	Understand the operation of SSB & VSB. And its representation in time domain & Frequency domain.	Understand
CO3	Understand the generation and detection of frequency modulation techniques	Understand
CO4	Analyze the noise performance in DSBSC , SSB, AM Receiver & FM Signals	Analyze
CO5	Understand the concept of Radio transmitters and receivers.	Understand
CO6	Understand the concepts of Pulse modulation techniques (PAM, PWM & PPM Techniques)	Understand

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO -1	2	2	2	-	1	-	-	-	-	-	-	-	2	2
CO -2	2	2	1	-	1	-	-	-	-	-	-	-	2	2
CO -3	2	2	-	-	1	-	-	-	-	-	-	-	2	2
CO -4	2	2	-	-	1	-	-	-	-	-	-	-	2	2
CO -5	1	1	2	-	-	-	-	-	-	-	-	-	2	2
CO -6	2	1	2	-	-	-	-	-	-	-	-	-	2	2

UNITI

Amplitude Modulation: 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, Envelop detector, Double side band suppressed carrier modulators, time domain and frequency domain description, Generation of DSB-SC Modulated waves, COSTAS Loop.

UNIT II

SSB Modulation: 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, Envelop detection of a VSB Wave pulse Carrier, Comparison of AM Techniques, Applications of different AM Systems.

UNIT III

Angle Modulation: Basic concepts, Frequency Modulation - Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band and 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 and AM.

UNIT IV

Noise: Noise in Analog Communication system, Types of Noise - Resistive (Thermal) Noise Source, Shot noise, Extraterrestrial Noise, Arbitrary Noise sources, White Noise, flicker noise Noise in DSB &SSB system, Noise in AM system, Noise in Angle Modulation system, Threshold effect in Angle Modulation system Pre-emphasis and de-emphasis.

UNIT V

Radio Transmitters: Classification of Transmitters, AM Transmitters - high level and low level AM transmitters, SSB Transmitters, Effect of feedback on performance of AM Transmitter, FM Transmitter – Variable reactance type and phase modulated FM Transmitter, frequency stability in FM Transmitter.

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.

UNIT VI

Pulse Modulation: Time Division Multiplexing, Types of Pulse modulation, PAM (Single polarity, double polarity) PWM -generation and demodulation of PWM, PPM - generation and demodulation of PPM, comparison between TDM and FDM.

TEXT BOOKS:

1. Principles of Communication Systems - Simon Haykin. 2nd Edition, John Wiley 2007.
2. Analog communication systems - Dr.sanjsy Sharma, 6th Edition S K kataria and sons 2016.

REFERENCE BOOKS:

1. Principles of Communication Systems – H Taub & D Schilling, Gautam Sahe, 3rd Edition, TMH, 2007.

2.Electronics & Communication System - George Kennedy and Bernard Davis, 4th Edition TMH 2009.

3. Analog Communications - KN Hari Bhat & Ganesh Rao, 2nd Edition, Pearson Publications, 2008.

4.Communication Systems 2nd Edition – R P Singh, S P Sapre, TMH, 2007.

5.Communication Systems – B P Lathi, B S Publication, 2006.

WEB LINKS :

1. http://onlinecourses.nptel.ac.in/noc17_ee06/course
2. http://www.smartzworld.com/downloads/download.ac-complete-notes-jntu
3. http://www.jantuworldupdates.org/analog-communication-system-ac
4. Freevideolectures.com/course/2314/communication-engineering/8

PULSE AND DIGITAL CIRCUITS	L	T	P	C
	3	1	0	3
II Year II Semester	Subject Code: 16EC4T13			

COURSE OBJECTIVES

The Students during the course will understand

1. The response of low pass & high pass circuits for different inputs.
2. Design & analyze of different clippers & clampers circuit using diode & transistors.
3. The switching characteristics of diode & transistor.
4. Realization of various logic gates using DTL, TTL & ECL logic families.
5. The analysis and design of different multi-vibrators & their applications.
6. Various time base generator (Miller, Bootstrap time base generator)
7. The principals of synchronization & frequency division.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Design RC Circuits for altering Non-sinusoidal signal	Understanding
CO2	Design various types of clippers & clampers using diodes.	Understanding
CO3	Apply the basic concepts of design different logic gates using different logic families	Applying
CO4	Design different multivibrators like bi-stable, constable and Astable multi's	Applying
CO5	Design different voltages time base generators.	Understanding
CO6	Design of memory elements and free running oscillators	Applying

The Mapping of CO and PO on 3 point scale {high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	1	1	2	-	-	-	-	-	-	-	-	-	2	-
CO-2	1	1	1	-	-	-	---	-	-	-	-	-	2	-
CO-3	1	1	1	2	2	-	-	-	-	-	-	2	2	-
CO-4	1	1	2	-	-	-	-	-	-	-	-	2	2	-
CO-5	1	1	2	1	-	-	-	-	-	-	-	-	2	-
CO-6	1	1	2	2	-	-	-	- -	- -	--	-	2	2	-

UNIT I

Linear Wave Shaping: High pass, Low pass RC circuits and their response for sinusoidal, step, pulse, square and ramp inputs. RC network as differentiator and integrator, attenuators and their

applications in CRO probe, RL and RLC circuits and their response for step input, Ringing circuit.

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.

UNIT III

Switching Characteristics of Devices: Diode as a switch, piece wise linear diode characteristics, Transistor as a switch, Break down voltage consideration of transistor, saturation parameters of Transistor and their variation with temperature, Design of transistors witch, transistor-switching times.

Digital Logic Gate Circuits: Realization of Logic Gates using DTL,TTL, ECL and CMOS logic circuits, Comparison of logic families.

UNIT IV

Multivibrators: Analysis & Design of Fixed Bias, Self Bias Bi-stable Multi vibrator, Emitter Coupled Bi-stable, Multi Vibrator (Schmitt trigger), Analysis and Design of Collector Coupled Mono-stable & Astable Multi-vibrators, Commutating capacitors, Triggering Methods, Application of Mono-stable Multivibrator as a Voltage to Time Converter, Application of Astable Multivibrator as a Voltage to Frequency Converter.

UNIT V

Voltage Time Base Generators: General features of a time base signal, methods of generating time base wave form, Miller and Bootstrap time base generators– basic principles, Transistor miller time base generator, Transistor Boot strap time base generator .

UNITVI

Synchronization and Frequency Division & Sampling Gates: Principles of Synchronization, Frequency division in sweep circuit, Astable relaxation circuits, Monostable relaxation circuits, Synchronization of a sweep circuit with symmetrical signals. Basic operating principles of sampling gates, Unidirectional and Bidirectional sampling gates, Reduction of pedestal in gate circuits, Applications of sampling gates.

TEXT BOOKS:

1. Pulse, Digital and Switching Waveforms by J Millman, H Taub and M S Prakash Rao, Mc-Graw Hill, 2007.

2. Pulse and Digital Circuits by AAnand Kumar, 2nd Edition, PHI, 2012.

REFERENCE BOOKS:

1. Solid state pulse circuits by David A Bell,4thedition, PHI, 2002.
2. Pulse, Digital Circuits and Computer fundamentals by R Venkataramana, Dhanpat Rai publications, 2010.

WEB LINKS:

1. https://www.smartzworld.com/notes/pdc
2. https://www.jntubook.com/pdc-textbook-free-download
3. Surkur.blogspot.in/pdc.html
4. https://www.facebook.com/IEINDIA/posts
5. nptel.ac.in/course/117106086/1
6. www.nptelvideos.in/2012/12/digital-circuits-and-systems.html

DATA STRUCTURES	L	T	P	C
	3	1	0	3
II Year II Semester	Subject Code: 16CS4T12			

COURSE OBJECTIVES

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Implement algorithmic complexities, recursive algorithms	Apply
CO2	Apply stack and queue techniques for logical operations	Apply
CO3	Understand List representation models in various types of applications	Understand
CO4	Implement trees in various forms	Apply
CO5	Get orientation on graphs, representation of graphs, graph traversals	Understand
CO6	Implement searching and sorting techniques	Analyze

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	3	0	0	3	1	1	0	2	1	0	2	3	2
CO-2	2	3	1	2	1	0	1	0	1	1	0	0	2	3
CO-3	2	3	1	1	1	0	0	0	1	0	0	0	2	2
CO-4	2	3	1	1	2	0	1	0	1	1	0	0	1	3
CO-5	3	3	2	2	2	1	1	0	1	1	0	0	2	2
CO-6	2	3	0	0	3	1	1	0	2	1	0	2	2	2

UNIT I:

Objective: exposure to algorithmic complexities, recursive algorithms

Preliminaries of algorithm, Algorithm analysis and complexity, **Data structure-** Definition, types of data structures

Recursion: Definition, Design Methodology and Implementation of recursive algorithms, Linear and binary recursion, recursive algorithms for factorial function, GCD computation, Fibonacci sequence, Towers of Hanoi, Tail recursion

UNIT II:

Objectives: Applying stack and queue techniques for logical operations

Stacks and Queues: Basic Stack Operations, Representation of a Stack using Arrays, Stack Applications: Reversing list, Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions. **Queues:** Basic Queues Operations, Representation of a Queue using array, Implementation of Queue, Operations using Stack, Applications of Queues-Round robin Algorithm, Circular Queues, Priority Queues.

UNIT III:

Objectives: Exposure to list representation models in various types of applications

Linked Lists: Introduction, single linked list, representation of a linked list in memory, Operations on a single linked list, Reversing a single linked list, applications of single linked list to represent polynomial expressions and sparse matrix manipulation, Advantages and disadvantages of single linked list, Circular linked list, Double linked list

UNIT IV:

Objectives: Implementation of tree implementation in various forms

Trees: Basic tree concepts, Binary Trees: Properties, Representation of Binary Trees using arrays and linked lists, operations on a Binary tree , Binary Tree Traversals (recursive), Creation of binary tree from in, pre and post order traversals.

UNIT-V:

Objectives: orientation on graphs, representation of graphs, graph traversals, spanning trees Graphs: Basic concepts, Representations of Graphs: using Linked list and adjacency matrix, Graph algorithms, Graph Traversals (BFS & DFS), applications: Dijkstra's shortest path, Transitive closure, Minimum Spanning Tree using Prim's Algorithm, warshall's Algorithm (Algorithmic **Concepts Only, No Programs required**).

UNIT VI:

Objective: exposure to searching and sorting techniques

List Searches using Linear Search, Binary Search, Fibonacci Search

Sorting Techniques: Basic concepts, Sorting by : insertion (Insertion sort), selection (heap sort), exchange(bubble sort, quick sort), distribution (radix sort) and merging (merge sort) Algorithms.

TEXT BOOKS:

1. Data Structure with C, Seymour Lipschutz, TMH
2. Data Structures using C,ReemaThareja, Oxford
3. Data Structures, 2/e, Richard F, Gilberg , Forouzan, Cengage
4. Data structures and algorithm analysis in C, 2nd ed, mark allenweiss

REFERENCE BOOKS:

1. Data Structures and Algorithms, 2008,G.A.V.Pai, TMH
2. Classic Data Structures, 2/e, Debasis ,Samanta,PHI,2009
3. Fundamentals of Data Structure in C, 2/e, Horowitz,Sahni, Anderson Freed, University Press

ELECTRONIC CIRCUIT ANALYSIS LAB	L	T	P	C
	-	-	3	2
II Year II Semester	Subject Code: 16EC4L02			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Design feedback amplifiers and oscillators using multisim and hardware	Applying
CO2	Design power amplifiers using hardware components and using multisim	Applying
CO3	Design the oscillators ,Darlington pair and bootstrapped emitter follower using hardware and multisim	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO -1	3	1	2	-	1	-	-	-	-	-	-	-	3	2
CO -2	3	1	2	-	1	-	-	-	-	-	-	-	2	2
CO -3	3	1	2	1		-	-	-	-	-	-		3	2

LIST OF EXPERIMENTS

A) DESIGN AND SIMULATION IN SIMULATION LAB USING MULTISIM:

1.Voltage Series Feedback Amplifier.

2. Current Shunt Feedback Amplifier.

3. RC Phase Shift Oscillator.

4. Colpitt's Oscillators.

5. Two Stage RC Coupled Amplifier.

6. Darlington Pair Amplifier.

7. Bootstrapped Emitter Follower

8. Class A Series-Fed Power Amplifier.

9. Class B Complimentary Symmetry Amplifier.

10. Single Tuned Voltage Amplifier

B) TESTING IN THE HARDWARE LABORATORY:

1. Voltage Series Feedback Amplifier.

2. Current Shunt Feedback Amplifier.

3. RC Phase Shift Oscillator.
4. Colpitt's Oscillators.
5. Two Stage RC Coupled Amplifier.
6. Darlington Pair Amplifier.
7. Bootstrapped Emitter Follower
8. Class A Series-Feed Power Amplifier.
9. Class B Complimentary Symmetry Amplifier.
10. Single Tuned Voltage Amplifier

ANALOG COMMUNICATIONS LAB	L	T	P	C
	-	-	3	2
II Year II Semester	Subject Code: 16EC4L03			

COURSE OBJECTIVES

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Demonstrate understanding of basic amplitude and frequency modulation and demodulation techniques	Understanding
CO2	Understand and explain the AGC, pre-emphasis, de-emphasis characteristics	Understanding
CO3	Demonstrate sampling theorem, PAM, PWM and PPM using Matlab Simulink tool	Understanding

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	1	2	-	2	-	-	-	-	1	-	-	2	2
CO-2	2	1	2	-	2	-	-	-	-	1	-	-	2	2
CO-3	2	1	2	-	2	-	-	-	-	1	-	-	2	2

List of Experiments (Any Twelve experiments to be done)

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

1. Amplitude Modulation & De-modulation
2. Amplitude modulation Double Side Band Suppressed Carrier - Modulation & De-modulation
3. Diode Detector
4. Pre-emphasis & De-emphasis
5. Frequency Modulation & De-modulation
6. Automatic Gain Control Circuits
7. Sampling Theorem
8. Pulse Amplitude Modulation & De-modulation
9. Pulse Width Modulation. & Demodulation
10. Pulse Position Modulation. & Demodulation

Software:

1. Amplitude Modulation & De-modulation
2. Amplitude modulation Double Side Band Suppressed Carrier - Modulation & De-modulation
3. Frequency Modulation & De-modulation
4. Verification of Sampling Theorem
5. Pulse Width and Pulse Position Modulation. & Demodulation
6. Pulse Amplitude Modulation & De-modulation

COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	C
	3	1	0	3
III Year I Semester	Subject Code: 16CS5T14			

Learning Objectives:

1. To impart an understanding of the internal organization and operations of a computer functional units.
2. To familiarize with the single and multiprocessor design architectures.

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO-1	Examine functional units, bus structure and analyzing the data representations.	Analyze
CO-2	Evaluation of micro operations of ALU.	Evaluate
CO-3	Design of CPU and micro programmed control units.	Create
CO-4	Applying algorithms to perform arithmetic operations on fixed point and floating point.	Apply
CO-5	Assessing memory hierarchy for accessing data by CPU	Evaluate
CO-6	Analyzing the I/O interfaces and multiprocessors architectures	Analyze

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO-1	3	1	2	2	-	-	-	-	-	-	-	1	1	1
CO-2	2	1	-	-	-	-	-	-	-	-	-	2	3	1
CO-3	2	1	3	2	-	-	-	-	-	-	-	1	2	-
CO-4	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO-5	2	1	-	-	-	-	-	-	-	-	-	3	2	-
CO-6	2	1	-	-	-	-	-	-	-	-	-	3	2	-

UNIT - I

Basic Structure of Computers: Computer Types, Functional unit, Basic Operational concepts, Bus structures. Data Representation: Data types, complements, fixed point representation. floating – point representation. Other binary codes-BCD-8421, 2421, excess-3, gray and excess-3 gray, error detection

codes.

UNIT - II

Register Transfer Language and Micro-operations: Register transfer language. register transfer bus and memory transfers, arithmetic micro operations, logic micro operations, shift micro operations, arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction codes, Computer Register Computer instructions, Instruction cycle, Memory – Reference Instructions. Input – Output and Interrupt.

UNIT - III

Central Processing Unit: General register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, reduced instruction set computer.

Micro Programmed Control: Control memory, address sequencing, micro program example.

UNIT - IV

Computer Arithmetic: Addition and subtraction, multiplication algorithms, division algorithms, floating – point arithmetic operations.

UNIT - V

The Memory System: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory.

Pipelining Arithmetic and Instruction Pipeline, Basics of vector processing and Array Processors.

UNIT-VI

Input-Output Organization: Peripheral devices, input-output interface, asynchronous data transfer, modes of transfer, priority interrupts, direct memory access.

Multi Processors: Introduction, characteristics or multiprocessors, interconnection structures, inter processor arbitration.

Text Books

1. Computer System Architecture, M.Morris Mano, 3/e, Pearson/PHI, 1993
2. Computer Organization, Carl Hamacher, ZvonksVranesic, SafeaZaky, 5/e, McGraw Hill, 2011.

References

1. Computer Organization and Architecture – William Stallings, 6/e, Pearson/PHI, 2012
2. Structured Computer Organization – Andrew S. Tanenbaum, 4/e, PHI/Pearson, 2012
3. Fundamentals or Computer Organization and Design, - Sivaraama Dandamudi Springer Int. Edition, 2014.
4. Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, 5/e, Elsevier, 2011

URLs

1. http://nptel.iitm.ac.in/video.php?subjectId=106106092
2. https://www.tutorialspoint.com/videos/computer_organization/index.htm
3. https://www.reference.com/technology/computer-organization-36c3a064b20f9b33
4. https://www.youtube.com/watch?v=CDO28Esqmcg&list=PLhwVAYxlh5dvB1MkZrcRZy6x_a2yORNAu

LINEAR IC APPLICATIONS	L	T	P	C
	3	1	0	3
III Year I Semester	Subject Code: 16EC5T14			

Course objectives

The student will

1. Study differential amplifier analysis for different modes of operation for DC and AC Analysis.
2. Study and measurement of DC and AC characteristics of OP-AMP.
3. Study the linear and non-linear applications of operational amplifier.
4. Study the oscillators, active filters and analog multipliers.
5. Study IC 555 timer, PLL and VCO with their applications.
6. Study and understand different types of ADCs and DACs.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO-1	Design differential amplifier for the given specifications	Analyze
CO-2	Analyze operational amplifier AC and DC Characteristics	Analyze
CO-3	Design of linear and non linear applications of Op-Amp for the given specifications	Analyze
CO-4	Elucidate and design the active filters and Oscillators	Analyze
CO-5	Apply the concept of IC 555 timer, PLL and VCO for communication applications	Apply
CO-6	Analyze A/D and D/A converters for signal processing applications	Analyze

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	2	1	1	-	-	-	-	-	-	-	-	2	1
CO-2	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO-3	1	1	2	1	-	-	-	-	-	-	-	-	1	2
CO-4	1	1	1	2	-	-	-	-	-	-	-	-	1	2
CO-5	1	1	1	2	-	-	-	-	-	-	-	-	1	2
CO-6	1	1	2	2	-	-	-	-	-	-	-	-	2	1

UNIT-I

ANALYSIS OF DIFFERENTIAL AMPLIFIER: Differential amplifiers analysis using BJT, emitter coupled differential amplifiers –DC analysis with R_E, differential amplifier using constant current source and determination of constant current, AC analysis of Differential amplifiers(dual input balanced output, single input balanced output, dual input unbalanced output, single input unbalanced output) –determination of R_i, R_o,A_d using r-parameters, Cascaded Differential Amplifier, current mirror circuit ,current repeater (basic and improved versions),level shifter circuit with constant current source- problem solving.

UNIT-II

CHARACTERISTICS OF OP-AMP: Characteristics of ideal op-amp, Power supplies, block diagram of op-amp, significance of each terminals, DC and AC characteristics.

Op-Amp parameters and Measurement: Input and Output Offset voltages and currents, slew rates, CMRR, PSRR, thermal drift -Problem Solving.

UNIT-III

LINEAR AND NON-LINEAR APPLICATIONS OF OP- AMPS: Ideal Inverting and Non-inverting amplifiers, summing amplifier, subtractor, basic Integrator and differentiator - Design and Problem Solving, Non ideal equivalent circuit of op-amp with inverting mode and non-inverting mode and determination of R_i, R_o, A_d, practical Integrator and differentiator, practical improved versions Instrumentation amplifier, Log and Anti log Amplifiers, V to I, I to V converters, comparator (inverting and non-inverting types) , zero crossing detector, Schmitt trigger, Square wave generator, function generators, monostable multivibrator, Precision rectifiers, peak detector- Design and Problem Solving.

UNIT-IV

OSCILLATORS, ACTIVE FILTERS, ANALOG MULTIPLIERS:RC phase shift oscillator, wien bridge oscillator, Butter worth filters- 1st order, 2nd order -LPF, HPF filters, 1st order - Band pass, Band reject and All pass filters, analog multiplier circuits- basic multiplier and its characteristics, applications of multiplier- voltage divider, squaring circuit ,square root circuit, doubler circuit, r.m.s detector, rectifier.

UNIT-V

TIMERS AND PHASE LOCKED LOOPS: Introduction to 555 timer, functional diagram, Monostable operations and applications- frequency divider, linear ramp generator, PWM, Astable operation and applications- FSK generator, PPM , Schmitt Trigger.

PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, voltage controlled oscillator 566 functional block diagram.

UNIT-VI

DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS: Introduction, basic DAC techniques- weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC. Different types of ADCs – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.

Text books

1. Linear Integrated Circuits – D. Roy Chowdhury, New Age International (p) Ltd, 2nd Edition,2003.
2. Op-Amps and Linear ICs - Ramakanth A. Gayakwad, PHI,1987.

References

1. Operational Amplifiers and Linear Integrated Circuits–R.F.Coughlin and Fredrick Driscoll, PHI, 6th Edition.
2. Operational Amplifiers – C.G. Clayton, Butterworth and Company Publishers Ltd./ Elsevier, 1971.
3. OP-AMPS and linear integrated circuits –Sanjay Sharma, S.K.Kataria and Sons , 2nd Edition 2012.

Web Link

http://nptel.ac.in/courses/1171070

DIGITAL IC APPLICATIONS	L	T	P	C
	3	1	0	3
III Year I Semester	Subject Code: 16EC5T15			

Course objectives:

The student will

1. Study the concepts of hardware description language for various levels of Abstraction.
2. Study various simulation techniques for synthesis process.
3. Understand the concepts of electrical behavior of CMOS and Bipolar logic both in static and dynamic conditions.
4. Understand Coding and design of various combinational circuits using hardware description language.
5. Design and develop Counters using Flip-flops and VHDL.
6. Study Modeling of Registers and Memories using VHDL.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO-1	Model logic circuits using hardware description language for digital applications.	Understanding
CO-2	Synthesize digital logic circuits using various simulation techniques.	Understanding
CO-3	Implement Basic Logic circuits using CMOS, TTL, ECL and their interfacing.	Analyze
CO-4	Design combinational logic circuits using VHDL	Analyze
CO-5	Design Counters using various types of Flip-Flops .	Analyze
CO-6	Analyze Memories with timing diagrams using hardware description language.	Analyze

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	1	2	2	-	-	-	-	-	-	-	-	-	1	1
CO-2	1	2	3	-	-	-	-	-	-	-	-	-	2	-
CO-3	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CO-4	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO-5	3	3	2	-	-	-	-	-	-	-	-	-	1	1
CO-6	1	3	2	-	-	-	-	-	-	-	-	-	1	1

UNIT-I

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, Objects and Classes, Subprograms, Comparison of VHDL and Verilog HDL.

UNIT-II

VHDL MODELLING: Simulation, Logic Synthesis, Inside a logic Synthesizer, Constraints, Technology Libraries, VHDL and Logic Synthesis, Functional Gate-Level verification, Place and Route, Post Layout Timing Simulation, Static Timing, Major Netlist formats for design representation, VHDL Synthesis-Programming Approach.

UNIT-III

DIGITAL LOGIC FAMILIES AND INTERFACING: Introduction to logic families, CMOS logic, CMOS steady state and dynamic electrical behavior, CMOS logic families, Bipolar logic, transistor-transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emitter coupled logic.

UNIT-IV

COMBINATIONAL LOGIC DESIGN: Adders And Subtractors, Ripple Adder, Look Ahead Carry Generator, Binary Parallel Adder, Binary Adder-Subtractor, ALU, Decoders, Encoders, Three State Devices, Multiplexers and De-Multiplexers, Code Converters, Parity Circuits, Comparators, Multipliers, Barrel Shifter, Simple Floating-Point Encoder, Cascading Comparators, Dual Priority Encoder, Design considerations with relevant Digital IC's, Modeling of circuits by using VHDL.

UNIT-V:

SEQUENTIAL LOGIC DESIGN: SSI Latches and Flip-Flops, Counters- ripple counter, synchronous counter Design of Counters using Digital ICs, Ring Counter, Johnson Counter, modeling of counters by using VHDL.

UNIT-VI

REGISTERS AND MEMORIES: MSI Registers, Shift Registers, Modes of Operation of Shift Registers, Universal Shift Registers, MSI Shift Registers, Design considerations with relevant Digital ICs, modeling of circuits by using VHDL.

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.

Text books

1. Digital Design Principles and Practices – John F.Wakerly, PHI/ Pearson Education Asia, 3rd Edition, 2005.

2. Fundamentals of Digital logic design with VHDL- Stephen Brown and Zvonko Vranesic, Tata McGraw Hill, 2nd edition.

References

1. VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3rd Edition.
2. Designing with TTL Integrated Circuits- Robert L. / John R. Morris and Miller, Tata McGraw Hill, 1971.

Web links

1. http://www.nptelvideos.in/2012/12/digital-systems-design

DIGITAL COMMUNICATIONS	L	T	P	C
	3	1	0	3
III Year I Semester	Subject Code: 16EC5T16			

Course objectives:

The student will

1. Understand the pulse digital modulation systems such as PCM, DPCM and DM.
2. Categorize various digital modulation techniques.
3. Explain the concept of transmission process, error calculation and concepts of matched filters.
4. Estimate the values of entropy and channel characteristics in source coding techniques.
5. Formulate the errors present in Block codes, cyclic codes.
6. Interpret and estimate the errors present in convolution codes.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Distinguish the performance of pulse digital modulation techniques.	Analyze
CO2	Interpret digital modulation techniques like ASK, FSK, PSK etc.	Understand
CO3	Evaluate the performance of digital modulation techniques for coherent and non-coherent detection.	evaluate
CO4	Apply the basic concepts of Information theory in source coding techniques.	apply
CO5	Analyze block codes and cyclic codes for the reliable transmission of digital information over the channel.	analyze
CO6	Implement convolution codes for digital communication applications.	Understand

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	3	2	2	-	-	-	-	-	-	-	-	2	-	1
CO-2	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO-3	2	3	2	-	-	-	-	-	-	-	-	-	-	-
CO-4	3	2	2	1	-	-	-	-	-	-	-	-	-	-
CO-5	2	2	1	3	-	-	-	-	-	-	-	-	1	-
CO-6	2	2	1	1	-	-	-	-	-	-	-	-	-	-

NIT-I

DIGITAL MODULATION: Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization and 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.

UNIT-II

DIGITAL MODULATION TECHNIQUES: Introduction, Modulation and Demodulation of ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-ary PSK, ASK, FSK, similarity of BFSK and BPSK.

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.

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: Introduction, 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.

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.

UNIT-VI

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

Text books

1. Digital and Analog Communication Systems - Sam Shanmugam, John Wiley, 2005.
2. Digital communications - Simon Haykin, John Wiley, 2005.

References

1. Principles of Communication Systems – H. Taub and D. Schilling, TMH, 2003.
2. Principles of digital communications- P.Chakrabarti,Dhanpat rai publication ,1991.
3. Digital Communications – John Proakis, TMH, 1983.

Web links

1. http://www.nptelvideos.in/2012/12/digital-communication.html

ANTENNAS AND PROPAGATION	L	T	P	C
	3	1	0	3
III Year I Semester	Subject Code: 16EC5T17			

Course objectives:

The student will

1. Learn the basic fundamentals of antennas.
2. Analyze the current distribution and EM field radiated by monopole, dipole and loop antennas.
3. Classify different types of antenna arrays and determine radiation patterns.
4. Study the constructional features of microstrip and helical antennas.
5. Study the characteristics of VHF, UHF and Microwave antennas.
6. Study the concepts of radio wave propagation in the atmosphere.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO-1	Identify basic antenna parameters in designing of antennas.	Understanding
CO-2	Evaluate current distribution and radiation pattern of wire antennas	Understanding
CO-3	Design antenna array based on principle of pattern multiplication to obtain radiation pattern.	Applying
CO-4	Design of Helical antenna for satellite and Mobile communications.	Applying
CO-5	Design parabolic, Lens and Horn antennas for microwave applications.	Applying
CO-6	Infer the characteristics of radio wave propagation in the atmosphere.	Understanding

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	1	1	1	-	-	-	-	-	-	-	-	-	2	-
CO-2	1	1	1	-	-	-	-	-	-	-	-	-	2	-
CO-3	2	1	2	1	-	-	1	-	-	-	-	-	2	-
CO-4	2	1	2	1	-	-	1	-	-	-	-	-	2	-
CO-5	2	1	2	1	-	-	1	-	-	-	-	-	2	-
CO-6	1	1	1	1	-	-	-	-	-	-	-	-	2	-

UNIT-I

ANTENNA FUNDAMENTALS: Introduction, Radiation Mechanism – single wire, 2 wire, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam widths, Polarization, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height, Antenna Theorems – Applicability and Proofs for equivalence of directional characteristics, illustrated Problems.

UNIT-II

THIN LINEAR WIRE ANTENNAS: Retarded Potentials, Radiation from Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Evaluation of Field Components, Power Radiated, Radiation Resistance, Beam widths, Directivity, Effective Area and Effective Height. Natural current distributions, fields and patterns of Thin Linear Center-fed Antennas of different lengths, Radiation Resistance at a point which is not current maximum.

Loop Antennas: Small Loops - Field Components, Comparison of far fields of small loop and short dipole, concept of short magnetic dipole, D and R_r relations for small loops.

UNIT III

ANTENNA ARRAYS : 2 element arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End-fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, arrays with Parasitic Elements, Yagi-Uda, Folded Dipoles and their characteristics.

UNIT-IV

NON-RESONANT RADIATORS: Introduction, Travelling wave radiators basic concepts, Long wire antennas – field strength calculations and patterns, Micro strip Antennas-Introduction, Features, Advantages and Limitations. Rectangular Patch Antennas –Geometry and Parameters, Impact of different parameters on characteristics.

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

UNIT-V

VHF,UHF AND MICROWAVE ANTENNAS: Reflector Antennas - Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, characteristics, types of feeds, F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Off-set Feeds, Cassegrain Feeds.

Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns; Lens Antennas – Geometry, Features, Dielectric Lenses and Zoning, Applications.

UNIT-VI

WAVE PROPAGATION: Concepts of Propagation – frequency ranges and types of propagations. Ground Wave Propagation–Characteristics, Parameters, Wave Tilt, Flat and Spherical Earth Considerations. Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF and Skip Distance – Calculations for flat and spherical earth cases, Optimum Frequency, LUHF, Virtual Height, Ionospheric Abnormalities, Ionospheric Absorption. Fundamental Equation for Free-Space Propagation, Basic Transmission Loss Calculations.

Space Wave Propagation – Mechanism, LOS and Radio Horizon. Tropospheric Wave Propagation – Radius of Curvature of path, Effective Earth's Radius, Effect of Earth's Curvature, Field Strength Calculations, Tropospheric Scattering.

Text books

1. Antennas for All Applications – John D.Kraus and Ronald J.Marhefka, TMH, 3rd Edition, 2003.
2. Electromagnetic Waves and Radiating Systems – E.C.Jordan and K.G.Balmain,PHI, 2nd Edition, 2000.

References

5. Antenna Theory - C.A. Balanis, John Wiley and Sons, 2nd Edition, 2001.
6. Antennas and Wave Propagation – K.D.Prasad, Satya Prakashan, Tech India Publications, New Delhi,2001.
7. Transmission and Propagation – E.V.D. Glazier and H.R.L.Lamont, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi.

PULSE AND DIGITAL CIRCUITS AND IC APPLICATIONS LAB	L	T	P	C
	0	0	3	2
III Year I Semester	Subject Code: 16EC5L04			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO-1	Generate and process sinusoidal and non sinusoidal signals by the concept of linear and non linear wave shaping	Applying
CO-2	Design and analyze various multivibrator circuits and bootstrap circuits	Applying
CO-3	Design and construct adders, subtractors and comparators, integrator and differentiators, active filters using operational amplifier	Applying
CO-4	Design and construct difference oscillator circuits using IC741 and to compare astable operation of IC 555 timer and IC 741	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	1	1	-	-	-	-	-	-	-	-	-	2	2
CO-2	1	1	2	-	-	-	-	-	-	-	-	-	2	2
CO-3	3	1	2	-	-	-	-	-	-	-	-	-	2	2
CO-4	2	1	2	-	-	-	-	-	-	-	-	-	2	2

List of Experiments to be conducted :

PULSE and DIGITAL CIRCUITS:

1. Linear wave shaping (RC Integrator and RC differentiator).
2. Non Linear wave shaping –Clippers.
3. Non Linear wave shaping –Clampers.
4. Schmitt Trigger.
5. Multivibrators.
6. Boot strap circuits.

IC APLICATION:

1. Study of ICs – IC 741, IC 555, IC 565, IC 566, IC 1496 – functioning, Parameters and Specifications.
2. OP AMP Applications – Adder, Subtracted, Comparator Circuits.
3. Design of Integrator and Differentiator Circuits using IC 741.

4. Design of Active Filters – LPF, HPF (first order) , BPF, Band Reject (Wideband) and Notch Filters
5. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.
6. Comparison of Astable Operation with IC 555 Timer and IC 741.

Equipment required for Laboratories:

1. RPS:(0 –30) V
2. CRO:(0 –20) MHz
3. Function Generators :(0 –3) MHz
4. Components
5. Multi Meters
6. Components:- IC741, IC555, IC565, IC1496, IC723, 7805, 7809, 7912 and other essential components.
7. Analog IC Tester

DIGITAL COMMUNICATIONS LAB	L	T	P	C
	0	0	3	2
III Year I Semester	Subject Code: 16EC5L05			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Multiplex multiple data, Digitize analog data using PCM, DM	Apply
CO2	Digitize analog data using Shift keying techniques like ASK,FSK,PSK,DPSK	Apply
CO3	Verification of companding, error detection and correction coding techniques	Apply

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	2	-	-	3	-	-	-	1	1	-	-	2	-
CO-2	2	2	-	-	3	-	-	-	1	1	-	-	2	-
CO-3	2	2	-	-	3	-	-	-	1	1	-	-	2	-

List of Experiments to be conducted:

PART-A:

1. Verification of Time division multiplexing and demultiplexing.
2. Pulse code modulation and demodulation.
3. Differential pulse code modulation and demodulation.
4. Delta modulation and demodulation.
5. Frequency shift keying.
6. Phase shift keying.
7. Differential phase shift keying.
8. Verification of Companding techniques using A-law and μ-law.
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

PART B:

Experiments using MATLAB

1. Simulation of PCM,DPCM
2. Simulation of DM ,ADM
3. Simulation of ASK,FSK
4. Simulation of PSK, M-ary PSK

Equipment required for Laboratories:

1. RPS - 0 – 30 V
2. CRO - 0 – 20 M Hz.
3. Function Generators - 0 – 1 M Hz
4. RF Generators - 0 – 1000 M Hz./0 – 100 M Hz.
5. Multi meters
6. Lab Experimental kits for Digital Communication
7. Components

Radio Receiver/TV Receiver Demo kits or Trainees.

DIGITAL IC APPLICATIONS LAB	L	T	P	C
	0	0	3	2
III Year I Semester	Subject Code: 16EC5L06			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Develop behavioral, data flow and structural models for digital circuits**.**	Applying
CO2	Simulate VHDL models of digital circuits using CAD tool.	Applying
CO3	Synthesize sequential and combinational circuits.	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	-	-	2	2	-	-	-	-	-	-	-	2	2
CO-2	2	-	-	2	2	-	-	-	-	-	-	-	2	2
CO-3	2	-	-	2	2	-	-	-	-	-	-	-	2	2

Note: The students are required to design and draw the internal logical structure of the following Digital Integrated Circuits and to develop VHDL/Verilog HDL Source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary synthesizer. All the experiments are required to verify and implement the logical operations on the latest FPGA Hardware in the Laboratory.

List of Experiments to be conducted:

1. Realization of Logic Gates
2. Design of Full Adder using 3 modeling systems
3. 3 to 8 Decoder -74138
4. 8 to 3 Encoder (with and without parity)
5. 8 x 1 Multiplexer-74151 and 2x 4 De-multiplexer-74155
6. 4- Bit comparator-7485
7. D Flip-Flop-7474
8. Decade counter -7490
9. Shift registers-7495
10. 8-bit serial in-parallel out and parallel in-serial out

11. Fast In and Fast Out (FIFO)
12. MAC (Multiplier and Accumulator)
13. ALU Design.

Equipment/Software required:

1. Xilinx Vivado software / Equivalent Industry Standard Software
2. Xilinx Hardware / Equivalent hardware.
3. Personal computer system with necessary software to run the programs and Implement.

PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
	0	3	0	0
III Year I Semester	Subject Code: 16BH5T17			

UNIT-I

Professional Ethics and Human values: Ethics -History of Ethics-Types of Ethics, Professional Ethics and its forms -Significance-Personal ethics vs Professional Ethics, Morals, Values — Integrity — Work Place Ethics and Business Ethics—Ethics in HRM, Finance, Marketing Management — Civic Virtue —Respect for others — Living Peacefully — Caring — Sharing — Honesty —Courage — Value time —Co-operation — Commitment Empathy — Self-confidence — Spirituality- Character.

UNIT-III

Engineering Ethics: Engineering Ethics-Meaning & Purpose of Engineering Ethics-Consensus and Controversy —Profession, Professional and Professionalism —Key Characteristics of Engineering Professionals Professional Roles to be played by an Engineer-Self Interest, Customs and Religion- Ethical Theories-Meaning & Uses of Ethical Theories-Types of Inquiry -Theories of moral Development-Kohlberg's Theory — Gilligan's Argument —Heinz's Dilemma.

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- Ethical issues involved in Clinical Trials.

UNIT-IV

Engineers' Responsibility for Safety and Risk: Concept of Safety-Types of Safety, Risk-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.

UNIT-V

Engineers Responsibilities and Rights: Collegiality-Techniques for Achieving Collegiality —Loyalty -Two Senses of Loyalty-obligations of Loyalty-Misguided

Loyalty — professionalism and Loyalty- Professional Rights —Professional Responsibilities — confidential and proprietary information-Conflict of Interest-solving conflict problems - 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.

UNIT-VI

Global Issues: Globalization-Problems of globalization- Cross-culture Issues-Environmental Ethics-Computer Ethics-computers as the instrument of Unethical behavior-computers as the object of Unethical Acts-autonomous computers-computer codes of Ethics-Weapons Development-Ethics and Research-Analyzing Ethical Problems in Research-Food and Drug Adulteration.

Relevant case studies shall be dealt where ever necessary.

Reference Books:

1. "Engineering Ethics includes 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-
5. "Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication
6. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinier -Tata McGraw-Hill -2003
7. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

DIGITAL SIGNAL PROCESSING	L	T	P	C
	3	1	0	3
III Year II Semester	Subject Code: 16EC6T19			

Course objectives:
The student will

1. Study the representation of discrete time signals, systems and their solutions using Z transforms.
2. Learn the concepts of DFS, DFT and FFT.
3. Study and design of infinite impulse response (IIR) digital filters.
4. Study the concepts and design of finite impulse response (FIR) digital filters.
5. Study various Digital Signal Processors and Architectures.
6. Learn about Multirate signal processing

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO-1	Finding the spectra of Digital signals	Remembering
CO-2	Finding the spectra of Digital signals using DFS,DFT,FFT	Understanding
CO-3	Realize the basic structures and Design of IIR	Applying
CO-4	Realize the basic structures and Design of FIR filter	Applying
CO-5	Basic idea on DSP processor	Understanding
CO-6	Basics of Multi Rate Signal Processing	Understanding

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO-2	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO-3	1	2	-	-	-	-	-	-	-	-	-	-	2	1
CO-4	1	1	-	-	-	-	-	-	-	-	-	-	2	1
CO-5	1	1	-	-	-	-	-	-	-	-	-	-	2	1
CO-6	2	1	2	-	-	-	-	-	-	-	-	-	2	1

UNIT-I

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

Review of Z-transforms: Applications of Z – transforms, solution of difference equations.

UNIT-II

DISCRETE FOURIER SERIES AND 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, Problem solving.

UNIT-III

REALIZATION OF DIGITAL FILTERS: Digital filters Basic structures of IIR systems, Transposed forms.

IIR DIGITAL FILTERS: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Analog-Digital transformations, Problem solving .

UNIT-IV

FIR DIGITAL FILTERS: Basic structures of FIR systems, System function, Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques, Frequency Sampling technique, Comparison of IIR and FIR filters.

UNIT-V

DSP PROCESSORS: Introduction to programmable DSPs- Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access scheme, Multiple access memory ,multiport memory, VLSI architecture, Pipelining, Special addressing modes, On-Chip Peripherals.

Architecture of TMS 320C5X- Introduction, 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.

UNIT-VI

MULTIRATE DIGITAL SIGNAL PROCESSING: Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion, sub band coding of speech signal.

Text books

1. Digital Signal Processing, Principles, Algorithms, and Applications --John G. Proakis, Dimitris G.Manolakis, 4th edition, PHI, 2013.
2. Digital Signal Processors, Architecture, Programming and Applications – B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002.

3. Digital signal Processing --A Anand Kumar, eastrn economy edition, PHI, 2013.

References

1. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer,4th edition ,PHI,2007.
2. Digital Signal Processing-- Tarunkumar Rawat, 1st edition, Oxford, 2015.

Web links

1.www.nptelvideos.in/2012/12/digital signal processing.html

MICRO PROCESSORS AND MICRO CONTROLLERS	L	T	P	C
	3	1	0	3
III Year II Semester	Subject Code: 16EC6T20			

Course objectives:

The student will

1. Study architecture and memory organization of 8086.
2. Learn Programming concepts of 8086.
3. Study the interfacing of 8086 with Peripheral devices (I/O devices).
4. Study the features and operating modes in advanced microprocessors (80386).
5. Learn the programming concepts of 8051 microcontroller.
6. Study architecture and features of PIC Microcontroller.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Analyze the concepts of architecture and key features of 8086	Analyzing
CO2	Develop Assembly Language Programs using 8086.	Creating
CO3	Design Interfacing for I/O devices like Stepper motor, LED displays with 8086.	Creating
CO4	Understand the functional features of advanced microprocessors (80386).	Understanding
CO5	Interface I/O devices like Keyboard, display units with 8051.	Understanding
CO6	Implement the concepts of PIC microcontroller in embedded real time project applications.	Analyzing

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-	3	-	-	-	-	-	-	-	-	-	-	-	1	2
CO-2	-	2	2	-	-	-	-	-	-	-	-	-	1	2
CO-3	3	-	2	-	-	-	-	-	-	-	-	-	2	2
CO-4	3	-	-	-	-	-	-	-	-	-	-	1	3	2
CO-5	3	-	2	-	-	-	-	-	-	-	-	1	3	2
CO-6	3	-	2	-	-	-	-	-	-	-	-	1	3	2

UNIT-I

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

UNIT-II

8086 PROGRAMMING: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT-III

8086 INTERFACING: Semiconductor memories interfacing (RAM,ROM), Intel 8255 programmable peripheral interface, alphanumeric displays (LED,7-segment display, multiplexed 7-segment display), Intel 8257 DMA controller, Intel 8259 programmable interrupt controller, software and hardware interrupt applications, Programmable communication interface 8251-USART,stepper motor,A/D and D/A converters

UNIT-IV

ADVANCED MICROPROCESSORS(80386): Salient features of 80386, Architecture of 80386, register organization of 80386, addressing modes, real mode, protected mode, segmentation and paging, Virtual 8086 mode and enhanced mode, instruction set of 80386, architectural differences between 80386 and 80486 microprocessors.

UNIT-V

Intel 8051 MICROCONTROLLER: Architecture, pin descriptions, input/output ports and circuits, memory organization, counters/timers, serial data input/output, interrupts. Assembly language programming: Instructions, addressing modes, simple programs. Interfacing: keyboard, displays (LED, 7-segment display unit).

UNIT-VI

PIC MICROCONTROLLER: Introduction, characteristics of PIC microcontroller, PIC microcontroller families, memory organization, parallel and serial input and output, timers, Interrupts, PIC 16F877 architecture, instruction set of the PIC 16F877.

ARM-Introduction to ARM Processors and applications in Embedded systems

Text Books

1. Microprocessors and Interfacing – Programming and Hard ware -Douglas V Hall, SSSP Rao, 3rd Edition, Tata McGraw Hill Education Private Limited.
2. The 8051 Microcontroller and Embedded Systems Using Assembly and C - Kenneth J.Ayala, Dhananjay V.Gadre,Cengage Learninbg , India Edition.

References

1. The Intel Microprocessors-Architecture, Programming, and Interfacing - Barry B.Brey, 8th Edition,Pearson, -2012.
2. Microprocessors and Microcontrollers-Architecture, Programming and System Design- Krishna Kant, Second Edition , PHI Learning Private Limited,2014.
3. Microprocessors and Microcontrollers- N.Senthil Kumar, M.Saravanan and S.Jeevananthan, Seventh Impression, Oxford University Press, 2013

Web link

1. https://www.nptel.ac.in/ downloads/ 106108100/
2. *enhanceedu.iiit.ac.in/wiki/images/ARM_architecture.pdf*

VLSI DESIGN	L	T	P	C
	3	1	0	3
III Year II Semester	Subject Code: 16EC6T21			

Course objectives:
The main objectives of this course are:

1. To enable the student to visualize MOS fabrication technologies and to understand electrical properties of MOS, CMOS and Bi CMOS circuits.
2. To train the student to draw integrated circuit layouts and stick diagrams following Lambda based design rules.
3. To gain knowledge in Basic circuit concepts and scaling for advanced VLSI design technology.
4. To learn input and output circuits of a Chip and testing and verification in VLSI design .
5. To understand the types of Architectures, Technologies and Families related to FPGA Design
6. To provide knowledge for the students on the importance to go for Low power VLSI and design applications.

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO-1	Demonstrate a clear understanding of CMOS fabrication flow and impact of electrical properties of MOS circuits in semiconductor industry.	Remembering
CO-2	Know three sets of design rules with which NMOS and CMOS design may be fabricated	Understanding
CO-3	Identify the interactions between process parameters, device structures, circuit performance for system design.	Applying
CO-4	Design complex digital systems using VLSI design methodology through testing and verification.	Creating
CO-5	Comprehend the types of FPGA's and their programming technologies, programmable logic block architectures and their inter connect.	Understanding
CO-6	Estimate the power dissipation in VLSI circuits through study of Switching capacitance, interconnect and clock	Creating

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	-	-	2	2	-	-	-	-	-	-	1	2	2
CO-2	-	-	-	2	2	-	-	-	-	-	-	1	2	2
CO-3	--	-	--	--	-	2	-	-	-	-	-	1	2	2
CO-4	--	-	2	-	-	-	-	-	-	-	-	1	2	2
CO-5	--	-	--	-	-	-	2	-	-	-	-	1	2	2
CO-6	--	-	--	-	2	-	-	-	-	-	-	1	2	2

UNIT-I

INTRODUCTION AND BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS: Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. I_{ds} versus V_{ds} Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-up, The CMOS Inverter, Latch-up in CMOS circuits, Bi-CMOS Inverter, Comparison between CMOS and BiCMOS technology.

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, 1.2µm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams Translation to Mask Form.

UNIT-III

BASIC CIRCUIT CONCEPTS: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, Some area Capacitance Calculations, The Delay Unit, Inverter Delays, Driving large capacitive loads, Propagation Delays, Wiring Capacitances, Choice of layers.

SCALING OF MOS CIRCUITS: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling, Limits due to sub threshold currents, Limits on logic levels and supply voltage due to noise and current density. Switch logic, Gate logic.

UNIT-IV

CHIP INPUT AND OUTPUT CIRCUITS: ESD Protection, Input Circuits, Output Circuits and L(di/dt) Noise, On-Chip clock Generation and Distribution.

DESIGN FOR TESTABILITY: Fault types and Models, Controllability and Observability, Ad Hoc Testable Design Techniques, Scan Based Techniques and Built-In Self Test techniques.

UNIT-V

FPGA DESIGN: FPGA design flow, Basic FPGA architecture, FPGA Technologies, FPGA families-Altera Flex 8000FPGA, Altera Flex 10FPGA, Xilinx XC4000 series FPGA, Xilinx Spartan XL FPGA, Xilinx Spartan II FPGAs, Xilinx Vertex FPGA. Case studies: FPGA Implementation of Half adder and full adder.

SYNTHESIS LEVELS: Logic synthesis, RTL synthesis, High level Synthesis.

UNIT-VI

LOW POWER VLSI DESIGN: Introduction to Deep submicron digital IC design, Low Power CMOS Logic Circuits: Over view of power consumption, Low –power design through voltage scaling, Estimation and optimisation of switching activity, Reduction of switching capacitance. Interconnect Design, Power Grid and Clock Design.

Test books

1. Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005.
2. CMOS Digital Integrated Circuits Analysis and Design- Sung-Mo Kang, Yusuf Leblebici, Tata Mc Graw Hill Education, 2003.

References

1. Advanced Digital Design with the Verilog HDL- Michael D.Ciletti, Xilinx Design Series, Pearson Education.
2. Analysis and Design of Digital Integrated Circuits in Deep submicron Technology- David Hodges, 3rd edition.

MANAGEMENT SCIENCE (Common to Civil, ECE,EEE,CSE,IT)	L	T	P	C
	3	1	0	3
III Year II Semester	Subject Code: 16BH6T15			

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO-1	Recognize management thoughts, motivational theories and types of organizations	Comprehension
CO-2	Apply the concepts of operations Management, such as Control Charts, work study, materials management for smooth functioning of production units	Applying
CO-3	Appraise the role of functional management in maximizing profits.	Evaluating
CO-4	Apply techniques of Project Management in controlling cost	Applying
CO-5	Apply principles of Strategic Management for managerial decisions	Applying
CO-6	Classify the management practices with reference to current business scenario	Comprehension

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	-	-	-	-	-	3	-	-	3	-	-	3	-	-
CO-2	-	3	-	-	-	-	-	-	-	-	3	-	-	-
CO-3	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO-4	-	3	-	-	-	-	-	-	-	-	3	-	-	-
CO-5	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-6	-	3	-	-	-	-	-	-	3	-	-	3	-	-

UIT - I

Introduction to Management: Concept —nature and importance of Management —Functions of Management — Evaluation of Management thought- Theories of Motivation — Decision making Process-Designing organization structure- Principles of organization - Types of organization structure.

UNIT- II

Operations Management: Production Management-functions— Work study-Statistical Quality Control- Control charts (P-chart, R-chart, and C-chart). Simple problems- Material Management:

Need for Inventory control- EOQ, ABC analysis (simple problems) and Types of ABC analysis (HML, SDE, VED, and FSN analysis).

UNIT - III

Functional Management: Concept of HRM, HRD and PMIR- Functions of HR Manager- Job Evaluation and Merit Rating, Balanced Score Card — Team Dynamics/Working in Teams - Marketing Management- Functions of Marketing —Marketing strategies based on Product Life Cycle.

UNIT - IV

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

UNIT - V

Entrepreneurship Management & Strategic Management: Entrepreneurship-features-Financial Institutions facilitating entrepreneurship — Startup culture. Strategic Management: Vision, Mission, Goals, Strategy — Elements of Corporate Planning Process — Environmental Scanning — SWOT analysis Steps in Strategy Formulation and Implementation, Generic Strategy Alternatives.

UNIT - VI

Introduction to Contemporary Management Practices: Basic concepts of MIS, Just In Time (AT) system, Total Quality Management (TOM), Lean Six Sigma, People Capability Maturity Model, Supply Chain Management, Evolution of Enterprise Systems, Business Process Outsourcing (BPO), Business Process Re-Engineering.

Text Books

1. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Management Science' Cengage, Delhi, 2012.
2. Dr. A. R. Aryasri, Management Science' TMH 2011.

REFERENCES

1. Koontz & Weihrich: 'Essentials of Management' TMH 2011
2. Seth & Rastogi: Global Management Systems, Cengage Learning, Delhi, 2011.
3. Robbins: Organizational Behaviors, Pearson Publications, 2011
4. Kanishka Bedi: Production & Operational Management, Oxford Publications, 2011
5. Manjunath: Management Science, Pearson Publications, 2013.
6. Biswajit Patnaik: Human Resource Management, PHI, 2011.
7. Hitt and Vijaya Kumar: Strategic Management, Cengage Learning.

8. Dr. PG. Ramanujam, BVR Naidu, PV Rama Sastry : Management Science Himalaya Publishing House, 2013.
9. Management Shapers, Universities Press.
10. Philip Kotler & Armstrong: Principles of Marketing, Pearson publications.
11. Principles of management and administration, D. Chandra Bose, Prentice Hall of India Pvt. Ltd. New Delhi.
12. Patterns of Entrepreneurship Management, jack M.kaplan

(OPEN ELECTIVE)

OOPS THROUGH JAVA	L	T	P	C
	3	1	0	3
III Year II Semester	Subject Code: 16CS6E06			

Learning objectives:

1. To make the students understand the fundamentals of Java programming and how to use Java to write applications.
2. To train the learners to implement and use OOPs concepts in JAVA

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Write, debug, and document well-structured Java applications	Understand
CO2	Apply decision and iteration control structures to implement algorithms and classes from the specifications.	Apply
CO3	Implement inheritance and packages	Apply
CO4	Implement the Exceptions and Multithreading concepts	Apply
CO5	Develop java programs using applet class.	Apply
CO6	Create java programs using Abstract Window toolkit.	Create

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2	3	-	-	-	-	-	1	-	3	3	3
CO2	3	3	3	2	3	-	-	-	-	-	1	-	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	1	-	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	1	-	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	1	-	3	3	3
CO6	3	3	3	3	3	-	-	-	-	-	1	-	3	3	3

UNIT – I

Introduction to OOP

Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, C++ vs Java, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK1.6 Variables , Primitive Data types, Identifiers- Naming Conventions, Keywords, Literals

UNIT - II

Programming Constructs

Operators- Binary, Unary and ternary, Expressions, Precedence rules and Associative, Primitive Type Conversion and Casting, Flow of control- Conditional, loops.,

Classes and Objects-

Classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments.

UNIT - III

Inheritance:

Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class

Interfaces, Packages and Enumeration:

Interface-Extending interface, Interface vs. Abstract classes, Packages-Creating packages, using Packages, Access protection, java.lang package.

UNIT – IV

Exceptions & Assertions –

Introduction, Exception handling techniques-try...catch, throw, throws, finally block, user defined exception, Exception Encapsulation and Enrichment, Assertions

Multi-Threading:

java.lang.Thread, the main Thread, Creation of new threads, Thread priority, Multithreading-Using isAlive () and join(), Synchronization, suspending and Resuming threads, Communication between Threads

UNIT – V

Input/output: reading and writing data, java.io package

Applets- Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint(),update() and repaint()

UNIT – VI

Event Handling

Introduction, Event Delegation Model, java.awt. event Description, Sources of Events, Event Listeners, Adapter classes, Inner classes

Abstract Window Toolkit

Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar

TEXT BOOKS:

1. The Complete Reference Java, 9ed, Herbert Schildt, TMH 9th edition, 2014
2. Programming in JAVA, Sachin Malhotra, Saurabh choudhary, Oxford university press india, 2nd edition, 2013.

REFERENCE BOOKS:

1. JAVA Programming, K.Raj kumar. Pearson, 1st edition, 2013
2. Object oriented programming with JAVA, Essentials and Applications, Raj KumarBuyya, Selvi, Chu TMH, 2009
3. Introduction to Java Programming, Y Daniel Liang, Pearson, 7th edition, 2009.
4. Core Java Volume 1.Fundamentals, Cay S.Horstmann, Gray Cornell, Pearson8th edition, 2007.
5. Advanced Programming in Java2: Updated to J2SE6 with Swing, Servlet and RMI, K.Somasundaram, jaico publishing house, 1st edition, 2008.

URLs:

1. https://www.tutorialspoint.com/java/java_object_classes.htm
2. http://beginnersbook.com/2015/07/java-swing-tutorial/
3. http://www.realapplets.com/tutorial/
4. https://www.youtube.com/watch?v=aUlwgdakBug
5. http://beginnersbook.com/2013/04/java-exception-handling/

DATA MINING	L	T	P	C
	3	1	0	3
III Year II Semester	Subject Code: 16CS6E07			

Learning Objectives:

1. Understand and implement classical models and algorithms in data mining.
2. Learn how to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Analyze real time datasets with basic summary statistics	Analyze
CO2	Apply different preprocessing methods, Similarity and Dissimilarity measures for any given raw data	Apply
CO3	Build decision tree and resolve the problem of model over fitting	Create
CO4	Compare Apriori and FP Growth association rule mining algorithms	Evaluate
CO5	Identify suitable clustering algorithm to interpret the results	Apply
CO6	Analyze web data mining techniques	Analyze

Mapping of COs, POs/PSOs:

CO#	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1				-	-	-	-	-	-	-	-	-	-	
CO.2				-	-	-	-	-	-	-	-	-	-	
CO.3				-	-	-	-	-	-	-	-	-	-	
CO.4				-	-	-	-	-	-	-	3	3	-	
CO.5				-	-	-	-	-	-	-		3	-	
CO.6				-	-	-	-	-	-	-	3	3	-	

UNIT –I:
Data Mining: Introduction, What is Data Mining?, Motivating challenges, The origins of Data Mining, Data Mining Tasks, Types of Data, Data Quality.

UNIT –II:
Data Preprocessing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature creation, Discretization and Binarization, Variable Transformation, Measures of

Similarity and Dissimilarity.

UNIT –III:
Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, Algorithm for decision tree induction, Model over fitting, evaluating the performance of classifier.

UNIT –IV:
Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Item Set Generation, Rule Generation, Compact Representation of Frequent Item sets, FP-Growth algorithm

UNIT –V:
Cluster Analysis: Basic Concepts and Algorithms: What is Cluster Analysis?, K-means, Strengths and Weaknesses, Agglomerative Hierarchical Clustering, Strengths and Weaknesses, The DBSCAN Algorithm, Strengths and Weaknesses.

UNIT –VI:
Web data mining: Introduction, Web terminology and characteristics, Web content mining, Web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of WebPages.

Text Books :

1. Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2nd edition, 2013.
2. Introduction to Data Mining with Case Studies: GK Gupta; Prentice Hall, 2nd edition, 2011.

Reference Books :

1. Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier, 3rd edition, 2011.
2. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
3. Data Mining : Introductory and Advanced topics : Dunham, Pearson.
4. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.
5. Data Mining Techniques, Arun K Pujari, Universities Press.

URLs

1. https://onlinecourses.nptel.ac.in/noc18_cs14/preview
2. https://www-users.cs.umn.edu/~kumar001/dmbook/index.php
3. http://hanj.cs.illinois.edu/bk3/bk3_slidesindex.htm

ROBOTICS	L	T	P	C
	3	1	0	3
III Year II Semester	Subject Code: 16ME6E01			

Course Objectives:

1. To make the students to know about robot applications, classifications of robot systems, robot controlling systems and robots with automation
2. To make the students to know about robot components, their architecture, work envelope and types of drive systems.
3. To make the students to know about robot transformations in the coordinate systems and world coordinate systems, kinematic relations
4. To make the students to know about differential transformations and Lagrange-Euler and Newton-Euler formulations.
5. To make the students to know about trajectory planning and motions, programming languages and software packages for path description to robots.
6. To make the students to know about types of robot actuators and feedback components. Robot applications in manufacturing.

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME
CO1	Upon successful completion of this course the student should be able to: Know about robot applications, classification of robot systems, robot controlling systems and robots with automation.
CO2	Understand about robot components, their architecture, work envelope and types of drive systems
CO3	Analyze about robot transformations in the coordinate systems and world coordinate systems, kinematic relations
CO4	Compile differential transformations and Lagrange-Euler and Newton-Euler formulations
CO5	Model the trajectory planning and motions, programming languages and software packages for path description to robots
CO6	Contrast about types of robot actuators and feedback components. Robot applications in manufacturing

Mapping of COs, POs/PSOs:

CO#	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2	1	2	-	2	-	-	-	-	-	-	2	-	2
CO.2	2	1	-	2	-	-	-	-	-	-	-	2	-	-
CO.3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO.4	2	1	2	-	-	-	-	-	-	-	-	2	-	-
CO.5	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO.6	1	1	-	-	-	-	-	-	-	-	-	2	-	-

UNIT – I

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

UNIT – II

Components of the Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT – III

Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT – IV

Differential transformations and manipulators Jacobians–problems.

Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

UNIT V

General considerations in path description and generation Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages-description of paths with a robot programming languages.

UNIT VI

Robot actuators and Feedback components:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.

REFERENCES:

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall.
3. Robot Analysis and Intelligence / Asada and Slow time / Wiley Inter-Science.
4. Introduction to Robotics / John J Craig / Pearson Edu.

POWER ELECTRONICS	L	T	P	C
	3	1	0	3
III Year II Semester	Subject Code: 16EE6E03			

Preamble:

The usage of power electronics in day to day life has increased in recent years. It is important for student to understand the fundamental principles behind all these converters. This course covers characteristics of semiconductor devices, ac/dc, dc/dc, ac/ac and dc/ac converters. The importance of using pulse width modulated techniques to obtain high quality power supply (dc/ac converter) and its application provided in industries is also discussed in detail in this course.

Course Objectives:

This course enables the students to

1. Study the characteristics of various power semiconductor devices and to design firing circuits for SCR.
2. Understand the operation of single phase half wave and full–wave converters
3. Get Knowledge on the operation of different types of DC-DC converters.
4. Understand the operation of inverters and application of PWM techniques for voltage control.
5. Explore the operation of AC-AC converters.
6. Understand switch mode power supplies and their applications.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Interpret the characteristics of various power semiconductor and design firing circuits for SCR.	Comprehension
CO2	Distinguish the operation of single phase half, fully controlled converters and dual converter.	Analysis
CO3	Relate the operation of three phase fully converters.	Knowledge
CO4	State the operation of dc–dc converters.	Understand
CO5	Analyze the working of inverters and application of PWM techniques for voltage control.	Analysis
CO6	Describe the operation of AC-AC converters.	Comprehension

Mapping of COs, POs/PSOs:

CO#	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2	1	2	-	-	-	-	-	-	-	-	-	-	-
CO.2	1	1	2	-	-	-	-	-	-	-	-	-	-	-
CO.3	1	2	2	-	1	-	-	-	-	-	-	1	-	-
CO.4	1	1	1	-	-	-	-	-	-	-	-	1	-	-
CO.5	1	1	2	-	-	-	-	-	-	-	-	1	-	-
CO.6	1	2	2	-	-	-	-	-	-	-	-	2	-	-

UNIT-I:

Power Semi-Conductor Devices

Thyristors– Silicon controlled rectifiers (SCR's) – Static characteristics of SCR–Turn on and turn off methods–Dynamic characteristics of SCR. Snubber circuit design - Firing circuits for SCR. Characteristics of power MOSFET and power IGBT

UNIT-II:

AC-DC Single-Phase Converters

Single phase half controlled rectifiers (continuous conduction mode) – R load and RL load with and without freewheeling diode – Single Phase fully controlled rectifiers (continuous conduction mode) with R load and RL load, with and without freewheeling diode.

UNIT-III:

DC–DC Converters

Buck Converter operation – Time ratio control and current limit control strategies–Voltage and current waveforms– Derivation of output voltage –Boost converter operation –Voltage and current waveforms–Derivation of output voltage. Buck- Boost converter operation.

UNIT-IV:

DC–AC Converters

Single phase half bridge and full bridge inverters with R and RL loads – Pulse Width Modulation (PWM) techniques– Quasi square wave and sinusoidal PWM techniques.

UNIT-V:

AC – AC Single-Phase Converters

Single phase AC-AC regulator phase angle control and integrated cycle control with R and RL load – For continuous and discontinuous conduction – Principle of operation of Cyclo-Converters.

UNIT-VI :

Switch Mode Power Supplies

Introduction to Linear Power Supplies- Overview of Switch Mode Power Supplies (SMPS) – DC to DC converters with electrical isolation – Control of Switch Mode DC Power Supplies –Time ratio control (TRC), Current limit control (CLC) – Power Supply Protection.

Static VAR Control, Power factor correction using Switch mode DC Power Supplies – Selection of drives and control schemes for steel rolling mills, paper mills, lifts, cranes etc.

Text Books:

1. Power Electronics – by P.S.Bhimbra, Khanna Publishers.
2. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998.
3. Power Electronics: Essentials & Applications by L. Umanand, Wiley, Pvt. Limited, India, 2009.

References:

1. Power Electronics: converters, applications & design -by Nedmohan, Tore M. Undeland, Robbins by Wiley India Pvt. Ltd.
2. Elements of Power Electronics–Philip T.Krein.oxford.
3. Power Electronics handbook by Muhammad H.Rashid, Elsevier.
4. Power Converter Circuits -by William Shepherd, Li zhang, CRC Taylor & Francis Group.
5. M.D.Singh, K.B.Khanchandani – Power Electronics. Tata Mcgraw –Hiill Publishing Company Limited.
6. Muhammad.H.Rashid – Power Electronics, Circuits, Devices & Applications Pearson Education.
7. Ashfeq Ahmed – Power Electronics For Technology , Pearson Education.
8. http://nptel.ac.in/courses/108101038/
9. https://www.electrical4u.com/concept-of-power-electronics/

BIO-MEDICAL INSTRUMENTATION	L	T	P	C
	3	1	0	3
III Year II Semester	Subject Code: 16EC6E02			

Course objectives:
The student will
1. Study the physiological relation of human body – environment.
2. Learn and Identify various errors that occur while measuring living system.
3. Study various types of Electrodes and Transducers used in biomedical measurements.
4. Learn Anatomy of Heart and Respiratory system.
5. Study various diagnostic and therapeutic techniques.
6. Study and prevent various Electric hazards of biomedical equipments.

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Study the physiological relation of human body environment	Understanding.
CO2	Learn and Identify various errors that occur while measuring living systems	Analyze
CO3	Study various types of electrodes and transducers used in bio-medical engineering	Understanding.
CO4	Learn anatomy of heart and respiratory system	Understanding.
CO5	Study various diagnostic and therapeutic techniques.	Understanding.
CO6	Study and prevent various electric hazards of biomedical equipment.	Understanding.

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	1	-	-	-	-	2	-	-	-	-	-	2	-	1
CO-2	1	-	-	-	-	2	-	-	-	-	-	2	-	1
CO-3	1	-	-	-	1	2	-	-	-	-	-	2	-	2
CO-4	1	-	-	-	1	2	-	-	-	-	-	2	-	2
CO-5	1	-	-	-	1	2	-	-	-	-	-	2	-	2
CO-6	1	-	-	-	1	2	-	-	-	-	-	2	-	-

UNIT-I

INTRODUCTION TO BIOMEDICAL INSTRUMENTATION: Age of Biomedical Engineering, Development of Biomedical Instrumentation, Man Instrumentation System, Components of the Man-Instrument System, Physiological System of the Body, Problems Encountered in Measuring a Living System, Sources of Bioelectric Potentials, Muscle, Bioelectric Potentials, Sources of Bioelectric Potentials, Resting and Action Potentials, Propagation of Action Potential, Bioelectric Potentials-ECG, EEG and EMG, Evoked Responses.

UNIT-II

ELECTRODES AND TRANSDUCERS: Introduction, Electrode Theory, Biopotential 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.

UNIT-III

CARDIOVASCULAR SYSTEM AND MEASUREMENTS: The Heart and Cardiovascular System, Electro Cardiograph, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart sound, Plethysmography, Angiogram and Angioplasty

MEASUREMENTS IN THE RESPIRATORY SYSTEM: The Physiology of the Respiratory System, Tests and Instrumentation for the Mechanics of Breathing, Respiratory Therapy Equipment.

UNIT-IV

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, Electrophysiological Tests, Ophthalmoscope, Tonometer for Eye Pressure Measurement, Diathermy, Clinical Laboratory Instruments, Biomaterials, Stimulators.

UNIT-V

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, Telemedicine Technology.

INTRODUCTION TO TELEMEDICINE, CYBER MEDICINE, APPLICATIONS OF TELEMEDICINE: Introduction to Biotelemetry, Physiological Parameters Adaptable to Biotelemetry, the Components of Biotelemetry System, Implantable Units, Telemetry for ECG Measurements during Exercise, Telemetry for Emergency Patient Monitoring.

UNIT-VI

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.

Text books

1. Bio-Medical Instrumentation – Leslie Cromwell, Fred J.Weibell, Erich A. Pfeiffer, 2nd edition, PHI, 2011.
2. Introduction to Bio-Medical Equipment Technology - Joseph J. Carr, John M. Brown, 4th edition, Pearson Publications.

References

1. Hand Book of Bio-Medical Instrumentation – R.S.Khandapur, McGrawHill, 2nd edition, 2003.
2. Biomedical Instrumentation – Dr. M. Arumugam, Anuradha Publications, 2006.

MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	C
	3	1	0	3
III Year II Semester	Subject Code: 16EE6E04			

Preamble:

This course presents the fundamentals of modeling and analysis of MEMS with a specialized focus on electro statically actuated systems. Topics include fundamentals of solid mechanics, electrostatics, and analytical and numerical methods for analyzing multiphysics systems. Students will develop a basic knowledge of MEMS that is of sufficient depth to begin reading the subject literature.

Course Objectives:

This course enables the students to

1. Learn basics of Micro Electro Mechanical Systems (MEMS).
2. Study about various thermal sensors and actuators used in MEMS.
3. Understand the principle and various devices of MEMS,
4. Introduce various magnetic sensors and actuators
5. Learn the principle and various devices of Fluidic systems.
6. Learn the principle and various devices of bio and chemical systems

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Analyze the basic concepts of MEMS and its applications.	Analysis
CO2	Discuss the thermal sensors and actuator types.	Comprehend
CO3	Acquire the knowledge on micro-opto-electro mechanical systems.	Knowledge
CO4	Examine the magnetic sensors and actuators types.	Application
CO5	Report the parameters of micro fluidic systems and radio frequency MEMS.	Comprehend
CO6	Discuss the chemical and bio medical micro systems parameters.	Comprehend

Mapping of COs, POs/PSOs:

CO#	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO.1	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO.2	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO.3	1	1	1	-	-	-	-	-	-	-	-	-	-	-
CO.4	2	1	1	-	-	-	-	-	-	-	-	-	2	-
CO.5	1	-	1	1	-	-	-	-	-	-	-	-	-	-
CO.6	1	2	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-I: Introduction

Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA.

Mechanical Sensors and Actuators: Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by microphone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

UNIT-II: Thermal Sensors and Actuators:

Thermal energy basics and heat transfer processes, thermisters, thermo devices, thermo couple, micro machined thermo couple probe, peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever.

UNIT-III: Micro- Opto-Electro Mechanical Systems:

Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.

UNIT-IV: Magnetic Sensors and Actuators

Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, MAG-MEMS actuators, by directional micro actuator, feedback circuit integrated magnetic actuator, large force reluctance actuator, magnetic probe based storage device.

UNIT-V: Micro Fluidic Systems:

Applications, considerations on micro scale fluid, fluid actuation methods, Dielectrophoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, Opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel, microfluid dispenser, micro needle, molecular gate, micro pumps.

Radio Frequency (RF) MEMS: RF – based communication systems, RF MEMS, MEMS inductors, varactors, tuner/filter, resonator, clarification of tuner, filter, resonator, MEMS switches, phase shifter.

UNIT-VI : Chemical and Bio Medical Micro Systems:

Sensing mechanism & principle, membrane-transducer materials, chem.-lab-on-a-chip (CLOC) chemo resistors, chemo capacitors, chemo transistors, electronic nose (E-nose), mass sensitive chemo sensors, fluorescence detection, calorimetric spectroscopy

Text Books:

1. MEMS, Nitaigour Premchand Mahalik, TMH Publishing co.
2. Foundation of MEMS, Chang Liu, Prentice Hall Ltd.

References:

1. MEMS and NEMS, Sergey Edwrd Lyshevski, CRC Press, Indian Edition.
2. MEMS and Micro Systems: Design and Manufacture, Tai-Ran Hsu, TMH Publishers.
3. Introductory MEMS, Thomas M Adams, Richard A Layton, Springer International Publishers.
4. https://www.mems-exchange.org/MEMS/what-is.html
5. http://www.lboro.ac.uk/microsites/mechman/research/ipm-tn/pdf/Technology_review/an-introduction-to-mems.pdf
6. https://www.slideshare.net/navinec1/micro-electromechanical-system-mems
7. https://en.wikipedia.org/wiki/Microelectromechanical_systems.

MICROPROCESSORS AND MICROCONTROLLERS LAB	L	T	P	C
	3	1	0	3
III Year II Semester	Subject Code: **16EC6L08**			

Course Outcomes:
The student will be able to do

CO	COURSE OUTCOME	BTL
CO1	Arithmetic operation, Logic operations-Shift and rotate, By using string operation and Instruction prefix	Apply
CO2	8259 – Interrupt Controller, 8279 – Keyboard Display, 8255 – PPI- and 8251 – USART	Apply
CO3	Reading and Writing on a parallel port, Timer in different modes, Serial communication implementation and interfacing of the microcontroller using 8051	Apply

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	2	2	-	-	-	-	-	-	-	-	-	-	3	2
CO 2	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO 3	3	3	-	-	-	-	-	-	-	-	-	-	2	2

LIST OF EXPERIMENTS

PART- A:

8086 Assembly Language Programming using Assembler Directives

1. Sorting.
2. Multibyte addition/subtraction
3. Sum of squares/cubes of a given n-numbers
4. Addition of n-BCD numbers
5. Factorial of given n-numbers
6. Multiplication and Division operations
7. Stack operations
8. BCD to Seven segment display codes

PART- B:

8086 interfacing

1. Hardware/Software Interrupt Application

2. A/D Interface through Intel 8255
3. D/A Interface through Intel 8255
4. Keyboard and Display Interface through Intel 8279
5. Generation of waveforms using Intel 8253/8254

PART- C:

8051 assembly Language Programs

1. Finding number of 1's and number of 0's in a given 8-bit number
2. Addition of even numbers from a given array
3. Ascending / Descending order
4. Average of n-numbers

PART-D:

8051 Interfacing

1. Switches and LEDs
2. 7-Segment display (multiplexed)
3. Stepper Motor Interface
4. Traffic Light Controller

Equipment Required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. 8086 Microprocessor kits
4. 8051 microcontroller kits
5. ADC module
6. DAC module
7. Stepper motor module
8. Keyboard module
9. LED, 7-Segemt Units
10. Digital Multimeters
11. ROM/RAM Interface module
12. Bread Board etc.

VLSI Laboratory	L	T	P	C
	0	0	3	2
III Year II Semester	Subject Code: **16EC6L09**			

The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the following experiments using CMOS 130nm Technology with necessary EDA tools (Mentor Graphics/Tanner).

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Design and implement basic and universal logic gates	Apply
CO2	Design and implement combinational and sequential logic circuits using their problem statement	Apply
CO3	Design and implement oscillators and memory blocks using mentor tools	Apply

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	3	2	3	2	2	-	-	-	-	-	-	-	2	2
CO-2	2	1	2	1	2	-	-	-	-	-	-	-	2	2
CO-3	2	2	3	2	3	-	-	-	-	-	-	-	3	2

List of Experiments based on the course-VLSI Design (16EC6T21):

1. Design and implementation of an inverter.
2. Design and implementation of universal gates.
3. Design and implementation of full adder.
4. Design and implementation of full subtractor.
5. Design and Implementation of Decoder.
6. Design and implementation of RS-latch.
7. Design and implementation of D-latch.
8. Design and implementation asynchronous counter.
9. Design and Implementation of static RAM cell.
10. Design and Implementation of 8 bit DAC using R-2R latter network.

11. Design and Implementation of differential amplifier.
12. Design and Implementation of ring oscillator.

Equipment Required:

1. Mentor Graphics/Tanner software-latest version
2. Personal computer with necessary peripherals

INTELLECTUAL PROPERTY RIGHTS AND PATENTS	L	T	P	C
	0	2	0	0
III Year II Semester	Subject Code: **16BH6T16**			

UNIT - I

Introduction to Intellectual Property Law — Evolutionary past — Intellectual Property Law Basics - Types of Intellectual Property - Innovations and Inventions of Trade related Intellectual Property Rights — Agencies Responsible for Intellectual Property Registration —WTO-WIPO-Regulatory — Over use or Misuse of Intellectual Property Rights - Compliance and Liability Issues.

UNIT - II

Introduction to Copyrights — Principles of Copyright — Subject Matters of Copyright — Rights Afforded by Copyright Law —Copyright Ownership — Transfer and Duration — Right to Prepare Derivative Works —Rights of Distribution — Rights of performers — Copyright Formalities and Registration — Limitations — Infringement of Copyright — International Copyright Law- Semiconductor Chip Protection Act.

UNIT - III

Introduction to Patent Law — Rights and Limitations — Rights under Patent Law —Patent Requirements — Product Patent and Process Patent- Ownership and Transfer — Patent Application Process and Granting of Patent — Patent Infringement and Litigation — International Patent Law — Double Patenting — Patent Searching —New developments in Patent Law

UNIT - IV

Introduction to Trade Mark — Trade Mark Registration Process — Post registration procedures — Trade Mark maintenance — Transfer of rights — Inter parties Proceedings — Infringement — Dilution of Ownership of Trade Mark — Likelihood of confusion — Trade Mark claims — Trade Marks Litigation — International Trade Mark Law.

UNIT -V

Introduction to Trade Secrets — Maintaining Trade Secret — Physical Security — Employee Access Limitation — Employee Confidentiality Agreement — Trade Secret Law — Unfair Competition — Trade Secret Litigation- Service Level Agreements Breach of Contract — Applying State Law.

UNIT - VI

Introduction to Cyber Law — Information Technology Act - Cyber Crime and E-commerce —Security -Data Security — Confidentiality — Data Privacy in India Vs Rest of the World.

Relevant Cases Shall be dealt where ever necessary.

REFERENCE BOOKS:

1. Deborah E.Bouchoux: "Intellectual Property". Cengage learning, New Delhi.
2. Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxfor University Press, New Delhi.
3. Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press).
4. Cyber Law. Texts & Cases, South-Western's Special Topics Collections.
5. Prabhuddha Ganguli: 'Intellectual Property Rights" Tata Mc-Graw — Hill, New Delhi
6. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
7. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
8. Ashok Kumar and Mohd.lqbal Ali: "Intellectual Property Right" Serials Pub.

COMPUTER NETWORKS	L	T	P	C
	3	1	0	3
IV Year I Semester	Subject Code: **16CS7T15**			

Course objectives:

The Student will

1. Understand the basic taxonomy, terminology and architectures of the computer networks.
2. Analyze the services, protocols and features of the various layers of computer networks.
3. Understand the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Distinguish the performance of pulse digital modulation techniques.	Understand
CO2	Interpret digital modulation techniques like ASK, FSK, PSK etc.	Analyze
CO3	Evaluate the performance of digital modulation techniques for coherent and non-coherent detection.	Analyze
CO4	Apply the basic concepts of Information theory in source coding techniques.	Understand
CO5	Analyze block codes and cyclic codes for the reliable transmission of digital information over the channel.	Understand
CO6	Implement convolution codes for digital communication applications.	Understand

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	-	-	-	-	-	-	-	-	2	-	1
CO2	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	1	-	-	-	-	-	-	-	-	-	-
CO5	2	2	1	3	-	-	-	-	-	-	-	-	1	-
CO6	2	2	1	1	-	-	-	-	-	-	-	-	-	-

UNIT - I:

Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards and administration; Comparison of the OSI and TCP/IP reference model.

Physical Layer: Guided transmission media, wireless transmission media.

UNIT - II:

Data Link Layer - design issues, Error Detection and error correction codes, CRC codes, Elementary Data Link Layer Protocols, Flow control -sliding window protocols: stop-and-wait ARQ, Go-back-n ARQ, Selective Repeat ARQ, HDLC

UNIT - III:

Multi Access Protocols - ALOHA, CSMA – CSMA/CD, CSMA/CA, Collision free protocols, data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways

UNIT - IV:

Network Layer: Network Layer Design issues, store and forward packet switching connection less and connection-oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Count- to -Infinity Problem, Hierarchical Routing.

UNIT - V:

Internetworking: Tunneling, Internetwork Routing, Packet fragmentation, IPv4, introduction to IPv6 Protocol, IP addresses, ICMP, ARP, RARP, DHCP.

UNIT - VI:

Transport Layer: Services provided to the upper layers elements of transport protocol- addressing connection establishment, connection release, Connection Release, Crash Recovery.

The internet transport protocols – UDP, TCP.

Application Layer- Introduction, providing services, Applications layer paradigms, Client server model, Standard client-server application-HTTP, FTP, electronic mail, TELNET, DNS, SSH

TEXT BOOKS:

1. Data Communications and Networking - Behrouz A.Forouzan98, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.

REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.
3. Introduction to Computer Networks and Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press.
4. Computer Networks, L. L. Peterson and B. S. Davie, 4th edition, ELSEVIER.
5. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose,
6. K. W. Ross, 3rd Edition, Pearson Education.

Web resources

1. http://nptel.ac.in/courses/106105081/1
2. http://epgp.inflibnet.ac.in/view_f.php?category=1736
3. http://media.pearsoncmg.com/ph/streaming/esm/tanenbaum5e_videonotes/tanenbaum_videoNotes.html

DIGITAL IMAGE PROCESSING	L	T	P	C
	3	1	0	3
IV Year I Semester	Subject Code: **16EC7T22**			

Course objectives:
The Student will

1. Learn basic concepts of digital image processing and image transforms.
2. Familiarize with histogram processing, image enhancement, spatial filtering for image smoothing and sharpening.
3. Learn various image noise models and restoration techniques.
4. Understand various image compression methods using coding techniques.
5. Learn fundamentals in image segmentation and various morphological operations.
6. Understand color image fundamentals and color models.

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Learn the fundamental concepts, applications of digital image processing and image transformation techniques	Remembering
CO2	Apply the concepts of intensity transformations in spatial filtering	Understanding
CO3	Filtering operation on images in spatial and frequency domains	Understanding
CO4	Apply the concepts of wavelets in image compression, water marking, segmentation	Understanding
CO5	Understand the different color models and color image processing	Remembering
CO6	Explain the concepts of image restoration and reformation	Understanding

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	2	1	-	-	-	-	-	-	-	-	2	2	2
CO-2	2	2	1	-	-	-	-	-	-	-	-	1	2	2
CO-3	3	2	1	--	-	-	-	-	-	-	-	2	2	2
CO-4	2	2	1	-	-	-	-	-	-	-	-	2	2	2
CO-5	2	2	2	-	-	-	-	-	-	-	-	2	2	2
CO-6	2	2	2	-	-	-	-	-	-	-	-	1	2	2

UNIT-I

INTRODUCTION: Introduction to image processing, fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing.

IMAGE TRANSFORMS: Need for image transforms, Discrete Fourier transform (DFT) of one variable and two variables, some properties of the 2-D Discrete Fourier transform, Importance of Walsh Transform. Hadamard transform, Haar transform, Slant transform, Discrete Cosine transform.

UNIT-II

INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING: Background, some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters , sharpening spatial filters, combining spatial enhancement methods.

FILTERING IN THE FREQUENCY DOMAIN: Preliminary concepts, the basics of filtering in the frequency domain, image smoothing using frequency domain filters, image sharpening using frequency domain filters, selective filtering.

UNIT-III

IMAGE RESTORATION: A model of the image degradation / restoration process, noise models, restoration in the presence of noise –only spatial filtering, periodic noise reduction by frequency domain filtering, linear, position –invariant degradations, estimating the degradation function, inverse filtering, minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter.

UNIT-IV

IMAGE COMPRESSION: Fundamentals, Basic compression methods- Huffman coding, arithmetic coding, LZW coding, run-length coding, bit-plane coding, block transform coding, Predictive coding.

WAVELETS: Image pyramids, sub band coding, wavelet transforms in one dimensions and two dimensions, wavelet coding.

UNIT-V

IMAGE SEGMENTATION: Fundamentals, point, line, edge detection, thresholding, region based segmentation.

MORPHOLOGICAL IMAGE PROCESSING: Preliminaries, erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology, segmentation using morphological watersheds.

UNIT-VI

COLOR IMAGE PROCESSING: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

Text books

1. Digital Image Processing --R. C. Gonzalez and R. E. Woods, 3rd edition, Prentice Hall of India, 2008.
2. Digital Image Processing -S.Sridhar,4th edition, Oxford higher education,2013.

Reference books

1. Fundamentals of Digital Image Processing-- Anil K.Jain, 9th Edition, Prentice Hall of India, Indian Reprint, 2002.
2. Digital Image Processing --Jayaraman, S. Esakkirajan, and T. Veerakumar, 8th Reprint, Tata McGraw-Hill Education, 2012.
3. Digital Image Processing and Analysis-- B.Chanda, D.Dutta Majumder, Prentice Hall of India, 2009.

Web links

http://nptel.ac.in/courses/106105032/

MICROWAVE ENGINEERING	L	T	P	C
	3	1	0	3
IV Year I Semester	Subject Code: **16EC7T23**			

Course objectives:

The student will study

1. Electromagnetic wave propagation in rectangular wave guide.
2. Different microwave junctions and components.
3. Scattering matrix of different 2-port, 3-port junctions.
4. Classifications of microwave tubes and working principles of klystron tubes.
5. Slow wave structures and M-type tubes.
6. Microwave solid state devices and measurement of microwave parameters.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Determine dominant modes and cut off frequencies of rectangular wave guides	Understand
CO2	Analyze different microwave junctions and components	Understand
CO3	Determine the S-matrix for microwave junctions like E-plane, H-plane and Magic Tee etc	Analyze
CO4	Compute power and efficiency of klystron tubes	Understand
CO5	Apply the knowledge of cross field tubes in microwave applications	Evaluate
CO6	Measure microwave parameters like phase, attenuation, impedance, frequency and VSWR	Understand

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	3	1	-	-	-	-	-	-	-	-	-	-	-
CO5	1	3	1	2	1	-	-	-	-	-	-	-	-	-
CO6	1	1	1	2	2	-	-	-	-	-	-	-	-	-

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, 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, Cavity Resonators– Introduction, Rectangular and Cylindrical Cavities Related Problems.

UNIT-II

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.

UNIT-III

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, S-Matrix Calculations for Isolator, Circulator, Related Problems.

UNIT-IV

MICROWAVE TUBES: Limitations and Losses of conventional tubes at microwave frequencies. Microwave tubes – O type and M type classifications. O-type tubes : 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process

REFLEX KLYSTRONS: Structure, Applegate Diagram and Principle of working, Oscillating Modes and output Characteristics, Electronic and Mechanical Tuning, Related Problems.

UNIT-V

HELIX TWTS: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Suppression of Oscillations, Nature of the four Propagation Constants.

M-TYPE TUBES: Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave. Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, output characteristics.

UNIT-VI

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, PIN diode and its applications.

MICROWAVE MEASUREMENTS: Description of Microwave Bench –Different Blocks and their Features, Precautions, Microwave Power Measurement – Calorimetric Method, Bolometer Method. Measurement of Attenuation, Frequency, VSWR, Cavity Q, Impedance Measurements.

Text books

1. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.
2. Microwave Circuits and Passive Devices – M.L. Sisodia and G.S.Raghuvanshi, Wiley Eastern Ltd., New Age International Publishers Ltd., 1995.

References

1. Microwave Devices and Circuits - Samuel Y.Liao, PHI,2009.
2. Microwave and Radar Engineering-Dr.M. Kulkarni,2nd edition, umesh publications,2008.
3. Microwave Engineering by Annapurna Das and Sisir Das by Mc Graw Hill

Web Link

http://nptel.ac.in/courses/117105130/

https://onlinecourses.nptel.ac.in/noc16_ec09

OPTICAL COMMUNICATIONS	L	T	P	C
	3	1	0	3
IV Year I Semester	Subject Code: **16EC7T24**			

Course objectives:

The student will study

1. The functionality of each of the components that comprise a fiber- optic communication system.
2. 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.
3. The principles of single and multi-mode optical fibers and their characteristics.
4. The working of optical sources and detectors.
5. The methods of source to fiber power launching.
6. The optical links for optical communication system.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Understand the basic concepts of optical fiber transmission link & modes of configuration	Understand
CO2	Understand different types of losses and dispersions	Understand
CO3	Analyze the optical fiber connectors & fiber splicing	Analyze
CO4	Analyze the optical source, filter & detector operation parameters	Knowledge
CO5	Design the optical network output patterns	Apply
CO6	Design a fiber optic link based on budgets and to improve the capacity of the system	Apply

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO-2	2	-	-	-	-	-	-	-	-	-	-	-	1	1
CO-3	-	2	-	-	-	-	-	-	-	-	-	-	1	1
CO-4	-	2	-	-	-	-	-	-	-	-	-	-	1	1
CO-5	1	1	2	-	-	-	-	-	-	-	-	1	1	1
CO-6	-	-	2	-	-	-	-	-	-	-	-	-	1	2

UNIT- I

OVERVIEW OF OPTICAL FIBER COMMUNICATION AND FIBER MATERIALS : 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, Glass halide, chalcogenide fibers, plastic optic fibers, active glass fibers.

UNIT- II

LOSES AND DISPERSION: Signal distortion in optical fibers-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Group delay, Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber, CNR, Related problems.

UNIT- III

OPTICAL FIBER COMPONENTS: 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.

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 and ILD.

OPTICAL DETECTORS- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors, Related problems.

UNIT- V

SOURCE TO FIBER POWER LAUNCHING : Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Optical Amplifiers ,Optical network concepts, Topologies, Laser diode to fiber coupling, Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources.

UNIT- VI

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, Analog links.

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.

References

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education,2005.
2. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.

Web links

http://www.nptel.ac.in/syllabus/117101054/

Elective- I

DIGITAL TELEVISION ENGINEERING	L	T	P	C
	3	1	0	3
IV Year I Semester	Subject Code: **16EC7D01**			

Course objective:

The student will

1. Study transmission standards and performance parameters of Digital TV.
2. Study channel coding and modulation techniques of Digital TV .
3. Study Transmitter and RF systems of television engineering.
4. Study transmission line parameters.
5. Acquire knowledge in Transmitting antennas.
6. Study testing and measurement of a Digital TV Transmission.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME
CO-1	Compare Digital TV transmission standards and performance parameters for high Quality Transmission
CO-2	Apply channel coding and modulation techniques to increase the performance of Digital TV
CO-3	Analyze RF amplifiers, modules and systems for Digital TV
CO-4	Identify Transmission lines suitable for Digital TV
CO-5	Know types of antennas suitable for Digital TV for better transmission Quality
CO-6	Test a Digital TV Transmitter and receiver for better broadcasting

UNIT- I

DIGITAL TELEVISION TRANSMISSION STANDARDS: ATSC terrestrial transmission standard, vestigial sideband modulation, DVB-T transmission standard, ISDB-T transmission standard, channel allocations, antenna height and power, MPEG-2.

PERFORMANCE OBJECTIVES FOR DIGITAL TELEVISION: System noise, external noise sources, transmission errors, error vector magnitude, eye pattern, interference, cochannel interference, adjacent channel interference, analog to digital TV, transmitter requirements.

UNIT-II

CHANNEL CODING AND MODULATION FOR DIGITAL TELEVISION: Data synchronization, randomization/scrambling, forward error correction, interleaving, inner code, frame sync insertion, quadrature modulation, 8 VSB, bandwidth, error rate, COFDM, flexibility, bandwidth.

UNIT- III

TRANSMITTERS FOR DIGITAL TELEVISION: Precorrection and equalization, up conversion, precise frequency control, RF amplifiers, solid-state transmitters, RF amplifier modules, power supplies, power combiners, Wilkinson combiner, ring combiner, star point combiner, cooling, automatic gain or level control, ac distribution, transmitter control, tube transmitters, tube or solid-state transmitters, performance quality, retrofit of analog transmitters for DTV.

RADIO-FREQUENCY SYSTEMS FOR DIGITAL TELEVISION: Constant-impedance filter, output filters, elliptic function filters, cavities, channel combiners.

UNIT-IV:

TRANSMISSION LINE FOR DIGITAL TELEVISION: Fundamental parameters, efficiency, effect of VSWR, system AERP, rigid coaxial transmission lines, dissipation, attenuation, and power handling, higher order modes, peak power rating, frequency response, standard lengths, corrugated coaxial cables, wind load, waveguide, bandwidth, waveguide attenuation, power rating, frequency response, size trade-offs, waveguide or coax pressurization.

UNIT-V

TRANSMITTING ANTENNAS FOR DIGITAL TELEVISION : Antenna patterns, elevation pattern, mechanical stability, null fill, azimuth pattern, slotted cylinder antennas, gain and directivity, power handling, antenna impedance, bandwidth and frequency response, multiple-channel operation, types of digital television broadcast antennas, antenna mounting.

UNIT-VI

TEST AND MEASUREMENT FOR DIGITAL TELEVISION: Power measurements, average power measurement, calorimetry, power meters, peak power measurement, measurement uncertainty, testing digital television transmitters.

Text books

1. Modern Television Practice – Principles, Technology and Service – R.R. Gulati, New Age International Publication, 2002.
2. Fundamentals of Digital television Transmission- Gerald w. Collins, Wilcy 2001

References

1. Colour Television Theory and Practice – S.P. Bali, TMH, 1994.
2. Television and Video Engineering - A.M. Dhake, 2nd Edition Mc Graw Hill, 1999.
3. Basic Television and Video Systems – B. Grob and C.E. Herndon, McGraw Hill, 1999.

RADAR ENGINEERING	L	T	P	C
	3	1	0	3
IV Year I Semester	Subject Code: **16EC7D02**			

Course Objectives:

The student will study:

1. The Basic Principle of radar and radar range equation.
2. Different types of radars; CW, FM-CW.
3. MTI and pulse Doppler radars performance.
4. Different tracking techniques for radar.
5. The characteristics of a matched filter receiver and its performance.
6. Different types of displays, duplexers and antennas used in radar systems.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO-1	Understand the basic concepts of radar	Understanding
CO-2	distinguish stationery and moving targets by Doppler effect and CW and FMCW radars	Analyzing
CO-3	understand about working of MTI and pulse Doppler radars	Understanding
CO-4	analyze basic tracking mechanisms and antenna parameters	Analyzing
CO-5	analyze features of radar transmitters and receivers	Analyzing
CO-6	design different types of duplexer and antenna	Analyzing

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-4	-	2	-	-	-	-	-	-	-	-	-	-	-	2
CO-5	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-6	-	-	2	-	-	-	-	-	-	-	-	-	-	1

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.

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.

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.

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.

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.

UNIT –VI

RADAR RECEIVERS : Duplexers – Branch type and Balanced type, Circulators as Duplexers, Radar Displays.

PHASED ARRAY RADAR -Introduction to Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Series versus parallel feeds, Applications, Advantages and Limitations. Radomes.

Text books

1. Introduction to Radar Systems -M.I. Skolnik, , 2nd Edition, Mc Graw Hill Book,1981.
2. Understanding of RADAR Systems - Simon Kingsley and Shaun Quegan, , McGraw Hill Book , 1993.

References

1. Radar Engineering and Fundamentals of Navigational Aids -G S N Raju, IK International Publishers, 2008.
2. Microwave and Radar Engineering , G.Sasi Bhushana Rao, , Pearson education, 2013

SYSTEM DESIGN THROUGH VERILOG	L	T	P	C
	3	1	0	3
IV Year I Semester	Subject Code: **16EC7D03**			

Course objectives:
Students undergoing this course are expected:

1. To understand the constructs and conventions of the Verilog HDL programming.
2. To understand the structural level of abstraction for modeling digital hardware systems.
3. To learn functional Bifurcation, various construct models, design using behavioral level.
4. To understand continuous assignment structures, delays in data flow level and bidirectional gates and time delays with switch primitives.
5. To understand synthesis of combinational logic and sequential logic circuits.
6. To study advanced features of verilog HDL and apply them to design complex real time digital systems.

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Ability to describe verilog HDL and design digital circuits in verilog	Knowledge
CO2	Design gate level modeling circuits	Knowledge
CO3	Design behavioral modeling circuits	Knowledge
CO4	Model the data flow level circuits and write switch level circuits	Analyze
CO5	Analyze the synthesis and sequential with flip flops	Analyze
CO6	Design verilog models like UART and microcontroller CPU	Apply

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	1	1	-	-	-	-	-	-	-	-	-	1	-
CO-2	-	-	2	-	-	-	-	-	-	-	-	-	1	-
CO-3	-	-	2	-	-	-	-	-	-	-	-	-	1	-
CO-4	1	1	-	-	-	-	-	-	-	-	-	-	1	-
CO-5	1	1	-	-	-	-	-	-	-	-	-	-	1	-
CO-6	-	-	2	-	-	-	-	-	-	-	-	-	1	1

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.

LANGUAGE CONSTRUCTS AND CONVENTIONS: Introduction, keywords, identifiers, whitespace characters, comments, numbers, strings, logic values, data types, scalars and vectors, parameters, memory, operators, system tasks.

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.

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 behavioral level, blocking and non blocking assignments, the case statement, simulation flow, if and if else constructs, assign-Deassign construct, repeat construct, FOR loop, the disable construct, While loop, Forever loop, parallel blocks, force-release construct, event.

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.

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 behavior 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.

UNIT-VI

VERILOG MODELS: Static RAM Memory, A simplified 486 Bus Model, Interfacing Memory to a Microprocessor Bus, UART Design and Design of Microcontroller CPU.

Text books

1. Fundamentals of Logic Design with Verilog – Stephen. Brown and Zvonko Vranesic, TMH, 2005.
2. A Verilog Primier – J. Bhasker, BSP, 2003.

References

1. Advanced Digital Design with Verilog HDL – Michael D. Ciletti, PHI, 2005.
2. Design through Verilog HDL – T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, IEEE Press, 2004.

Elective- II

EMBEDDED SYSTEMS	L	T	P	C
	3	1	0	3
IV Year I Semester	Subject Code: **16EC7D04**			

Course objectives:
The student will

1. Study the basic concepts of an embedded system are introduced.
2. Know the various elements of embedded hardware and their design principles are explained.
3. Learn different steps involved in the design and development of firmware for embedded systems is elaborated.
4. Study the Internals of Real-Time operating system and the Fundamental issues in hardware software co-design were presented and explained.
5. Familiarize with the different IDEs for firmware development for different family of processors/controllers and embedded operating systems.
6. Discuss Embedded system implementation and testing tools

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Understand the basic concept of embedded system	Understanding
CO2	Know an embedded system design approach to to control the function of various hardware	Applying
CO3	familiarize with embedded firm design approach to control the function of various hardware	Applying
CO4	Identify the unique characteristics of real time environment , operating system and evaluate the need for RTOS	Applying
CO5	understand the integration of hardware and firmware of an embedded system using RTOS	Understanding
CO6	Test a embedded system design using testing tools for quality of design	Analyzing

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO-1	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO-2	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO-3	-	-	2	-	-	-	-	-	-	-	-	-	1	-
CO-4	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO-5	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO-6	2	2	-	-	-	-	-	-	-	-	-	-	2	-

UNIT-I

INTRODUCTION: Embedded system-Definition, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system, Introduction to IOT Devices.

UNIT-II

EMBEDDED HARDWARE DESIGN: Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

UNIT-III

EMBEDDED FIRMWARE DESIGN AND PROGRAMING CONCEPTS: Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

UNIT-IV

REAL TIME OPERATING SYSTEM: Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronization, Device Drivers.

HARDWARE SOFTWARE CO-DESIGN: Fundamental Issues in Hardware Software Co-Design, Middle ware, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware, ICE.

UNIT-V

EMBEDDED SYSTEM DEVELOPMENT: The integrated development environment, Types of files generated on cross-compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools.

UNIT-VI

EMBEDDED SYSTEM IMPLEMENTATION AND TESTING: The main software utility tool, CAD and the hardware, Translation tools-Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools.

Text Books

1. Embedded Systems Architecture- By Tammy Noergard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.

References

1. Embedded Systems-Lyla B.Das-Pearson Publications, 2013.
2. An Embedded Software Primer -David E.Simon, Pearson Education Asia, First Indian Reprint 2000.

ANALOG IC DESIGN	L	T	P	C
	3	1	0	3
IV Year I Semester	Subject Code: **16EC7D05**			

Course objectives:
The student will:

1. Study the concepts of MOS Devices, Small-Signal and Large-Signal Modeling of MOS Transistor.
2. Learn the MOS elements and Analog Sub-Circuits.
3. Study the CMOS Amplifiers like Differential Amplifiers, Cascode Amplifiers, Output Amplifiers and Operational Amplifiers with design considerations.
4. Distinguish the Analog CMOS Circuits for Analog operations.
5. Construct Comparator circuits improving the Performance of Open-Loop Comparators.
6. Design comparators and PLL's.

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME
CO1	Apply the concepts of MOS Devices and Modeling involved in IC circuits
CO2	Summarize the MOS sub circuits used in CMOS analog circuit design
CO3	Analyze amplifiers using CMOS technology used in Analog electronics
CO4	Design high-performance operational amplifier combining compensation circuits which are widely used in A/D and D/A Converters
CO5	Analyze the Comparators in terms of performance to measure and digitize analog signals
CO6	Design Oscillators and PLL'S which has extensive applications in communication systems

Mapping of COs, POs/PSOs:

CO#	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO.1	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO.2	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO.3	1	1	1	-	-	-	-	-	-	-	-	-	-	-
CO.4	2	1	1	-	-	-	-	-	-	-	-	-	2	-
CO.5	1	-	1	1	-	-	-	-	-	-	-	-	-	-
CO.6	1	2	-	-	-	-	-	-	-	-	-	-	-	-

UNIT -I

MOS DEVICES AND MODELING: The MOS Transistor, Passive Components- Capacitor and Resistor, Integrated circuit Layout, CMOS Device Modeling – Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation, Models, Sub-threshold MOS Model.

UNIT -II

ANALOG CMOS SUB-CIRCUITS: MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT -III

CMOS AMPLIFIERS: Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

UNIT -IV

CMOS OPERATIONAL AMPLIFIERS: Design of CMOS Op -Amps, Compensation of Op-Amps, Design of Two-Stage Op-Amps, Power- Supply Rejection Ratio of Two-Stage Op- Amps, Cascade Op- Amps, Measurement Techniques of OP-Amp.

UNIT -V

COMPARATORS: Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete- Time Comparators.

UNIT -VI

OSCILLATORS AND PHASE-LOCKED LOOPS: General Considerations, Ring Oscillators, LC Oscillators, Voltage Controlled Oscillators. Simple PLL, Charge Pump PLLs, Non-Ideal Effects in PLLs, Delay Locked Loops, Applications.

Text Books

1. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH .
2. CMOS Analog Circuit Design – Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

References

1. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, 5TH Edition, 2010.
2. Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edition, 2013

NETWORK SECURITY AND CRYPTOGRAPHY	L	T	P	C
	3	1	0	3
IV Year I Semester	Subject Code: **16EC7D06**			

Course Objective:
The student will

1. Understand symmetric block ciphers (DES, AES, other contemporary symmetric ciphers), Public-key cryptography (RSA, discrete logarithms).

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Analyze the functional units of security model	Analyze
CO2	Evaluate security mechanisms with Symmetric Key cryptography	Evaluate
CO3	Evaluate security mechanisms with Asymmetric Key cryptography	Evaluate
CO4	Analyze Data Integrity, Digital Signature Schemes & Key Management	Analyze
CO5	Analyze network security models for ensuring security at Application layer and Transport layer.	Analyze
CO6	Analyze network security model at Network layer	Analyze

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	3	2	-	1	-	-	-	-	-	-	-	-	2	-
CO-2	-	1	-	1	-	-	-	-	-	-	-	-	-	1
CO-3	-	-	1	-	-	-	-	-	-	-	-	-	-	1
CO-4	-	2	2	1	-	-	-	-	-	-	-	-	-	-
CO-5	-	-	-	2	3	-	-	-	-	-	-	-	-	-
CO-6	-	-	-	-	3	-	-	-	-	-	-	-	-	-

UNIT- I:

Classical Encryption Techniques

Security attacks, services & mechanisms, Network Security Model, Non-Cryptographic Protocol Vulnerabilities, Cryptography basics, Symmetric Cipher Model, Cryptanalysis and brute force attacks, Substitution and transposition techniques.

UNIT- II:

Block Ciphers & Symmetric Key Cryptography

Stream ciphers & Block ciphers, Feistel Cipher, DES, Triple DES, AES.

UNIT- III:

Number Theory & Asymmetric Key Cryptography

Number Theory: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder theorem, Discrete logarithms.

Public Key Cryptography: Principles, public key cryptosystems, RSA Algorithms, Diffie Hellman Key Exchange, Elgamal encryption & decryption, Elliptic Curve Cryptography.

UNIT- IV:

Cryptographic Hash Functions & Digital Signatures

Application of Cryptographic hash Functions, Requirements & Security, Secure Hash Algorithm(SHA-512), Message Authentication Functions, Requirements & Security, HMAC & CMAC. Digital Signatures, NIST Digital Signature Algorithm. Key management & distribution.

UNIT -V:

Network Security-I (Transport Layer Security & Email Security)

Transport Level Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Shell (SSH)

Electronic Mail Security: Pretty Good Privacy (PGP) and S/MIME

UNIT -VI:

Network Security-II

IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Intrusion detection: Overview, Approaches for IDS/IPS, Signature based IDS, Host based IDS/IPS.

TEXT BOOKS:

1. Cryptography & Network Security: Principles and Practices, William Stallings, PEA, Sixth edition.
2. Introduction to Computer Networks & Cyber Security, Chwan Hwa Wu, J.David Irwin, CRC press.

REFERENCE BOOKS:

1. Network Security and Cryptography, Bernard Meneges, Cengage Learning.
2. Everyday Cryptography, Keith M.Martin, Oxford

3. Cryptography and Network Security, Behrouz A Forouzan, DebdeepMukhopadhyay, (3e) Mc Graw Hill.

URLs

1. http://nptel.ac.in/courses/106105031/
2. http://williamstallings.com/Extras/Security-Notes/

MICROWAVE ENGINEERING AND OPTICAL LAB	L	T	P	C
	0	0	3	2
IV Year I Semester	Subject Code: **16EC7L10**			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Measure the characteristics of microwave devices and circuits: Reflex klystron, Gunn Diode, Directional Coupler.	Applying
CO2	Measure of microwave device parameters: Attenuation, VSWR, Impedance, Frequency, Waveguide, Circulator, Magic Tee.	Applying
CO3	Measure the characteristics of optical devices: LED, Laser diode, NA, Losses, Data rate, Intensity Modulation.	Applying

The Mapping of CO and PO on 3 point scale {high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	1	1	2	-	-	-	-	-	-	-	-	-	2	2
CO-2	2	2	1	-	-	-	-	-	-	-	-	-	2	2
CO-3	1	1	2	-	-	-	-	-	-	-	-	-	2	2

List of Experiments to be conducted:

Part – A

1. To verify Reflex Klystron Characteristics and to determine the frequency and tuning range of reflex klystron.
2. To verify Gunn Diode Characteristics.
3. To determine crystal index of the detector diode.
4. To draw the calibration curve of the attenuator.
5. To determine the coupling factors and directivity of directional coupler.
6. To measure the power distribution of various wave guide Tee i.e. E plane, H plane.
7. To measure the power distribution of various wave guide Magic Tee
8. VSWR Measurement and load impedance calculations using smith chart.
9. Scattering parameters of Circulator.
10. To measure the radiation pattern of antennas.
11. Characterization of Microstrip components.

Part – B

12. Characterization of LED.
13. Characterization of Laser Diode.
14. Intensity modulation of Laser output through an optical fiber.
15. Measurement of Data rate for Digital Optical link.
16. Measurement of Numerical Aperture of fiber cable.
17. Measurement of losses for Analog Optical link.

Add on experiment: (As a mini project)

18. Design of micro strip antenna.

Equipment required for Laboratories:

1. Regulated Klystron Power Supply
2. VSWR Meter -
3. Micro Ammeter - 0 – 500 μA
4. Multi meter
5. CRO
6. GUNN Power Supply, Pin Modulator
7. Reflex Klystron
8. Crystal Diodes
9. Micro wave components (Attenuation)
10. Frequency Meter
11. Slotted line carriage
12. Probe detector
13. wave guide shorts
14. Pyramidal Horn Antennas
15. Directional Coupler
16. E, H, Magic Tees
17. Circulators, Isolator
18. Matched Loads
19. Fiber Optic Analog Trainer based LED
20. Fiber Optic Analog Trainer based laser
21. Fiber Optic Digital Trainer
22. Fiber cables - (Plastic, Glass)

DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
	0	0	3	2
IV Year I Semester	Subject Code: **16EC7L11**			

Course Outcomes:
The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Study the architecture of TMS320C54XX DSP and simulation of convolution, digital filters and FFT using code composer studio	Understanding
CO2	Implementation of convolution, digital filters and FFT using MAT LAB	Applying
CO3	Simulation of image operations like filtering, compression, segmentation using MAT LAB	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	1	-	-	-	-	-	-	-	-	-	-	-	1	1
CO-2	2	1	2	-	1	-	-	-	-	-	-	-	2	1
CO-3	2	1	1	-	-	-	-	-	-	-	-	-	2	1

LIST OF EXPERIMENTS:

1. To verify linear convolution, circular convolution.
2. To design FIR filter (LP/HP) using windowing technique
   a) Using rectangular window
   b) Using triangular window
3. To Implement IIR filter (LP/HP) on DSP Processors
4. N-point FFT algorithm.
5. MATLAB program to find frequency response of analog LP/HP filters.
6. Perform Basic operations on image (shrinking, zooming and cropping)
7. Implement smoothing and sharpening of image using low pass and high pass filter.
8. Perform image restoration using special filters.
9. Implement edge, line detection using operators.
10. Implement image compression bit plane coding.

11. Perform morphological operations on image.

ADD ON EXPERIMENTS:

1. To verify linear convolution using MATLAB
2. To verify circular convolution using MATLAB

CELLULAR AND MOBILE COMMUNICATION	L	T	P	C
	3	1	0	3
IV Year II Semester	Subject Code: **16EC8T25**			

Course Objective:

The student will Study

1. The cellular systems and its Operation.
2. Various types of interferences and frequency management techniques.
3. The antennas used cell sites.
4. The concept of signal reflectors and cell coverage.
5. The concept of handoff techniques and cell site.
6. The Architecture of GSM and OFDM**.**

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Understand the components of cellular system and its performance.	Understanding
CO2	Demonstrate the effects of frequency management and channel assignments to reduce interference	Understanding
CO3	Identify the suitable antennas for cell sites.	Applying
CO4	Demonstrate the problems in cell coverage's in terrains like flat, hill area and on water.	Understanding
CO5	Understand the concept of handoff to reduce dropped calls.	Understanding
CO6	Understand the architectures of GSM, OFDM used in technologies like 2G, 3G and 4G.	Understanding

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO-2	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO-3	2	2	2	-	-	-	-	-	-	-	-	-	2	3
CO-4	2	1	-	-	-	-	-	-	-	-	-	-	2	2
CO-5	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO-6	2	-	-	-	-	-	-	-	-	-	-	-	2	2

UNIT-I

INTRODUCTION TO CELLULAR MOBILE SYSTEMS: A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Consideration of the components of cellular systems, Analog and digital cellular systems, General Description of Cellular Radio System design problem and concept of frequency reuse channels.

UNIT-II

CHANNEL INTERFERENCE AND CHANNEL ASSIGNMENT: Introduction to Co-Channel Interference, Real-Time Co-channel Interference, Co-channel interference reduction factor, Desired C/I from a normal case in a Omni Directional Antenna System, Non Co-Channel Interference-different types.

FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT: Frequency Management, Set-up channels and Paging Channels, Channel assignment to the cell sites and mobile units, Channel sharing and borrowing, Sectorization and Overlaid Cells, Non-fixed channel assignment.

UNIT-III

CELL SITE AND MOBILE ANTENNAS: Design of Antenna System, Antenna Parameters and their Effects, Equivalent Circuits of Antennas, Sum and difference patterns and their synthesis, For Coverage use – Omni directional Antennas, For interference reduction use – Directional antennas, Space diversity antennas and Umbrella pattern antennas, Unique Situations of Cell site antennas, Mobile Antennas.

UNIT-IV

CELL COVERAGE FOR SIGNAL AND TRAFFIC: Signal reflections in flat and hilly terrain, Effect of Human made Structures, Phase difference between direct and reflected paths, Constant standard deviation and straight line path loss slope, General formula for mobile radio propagation over water or Flat open area, Near and long distance propagation Antenna height gain, Form of a Point-to-point Model.

UNIT-V

HANDOFFS AND CELL SPLITTING: Types of Handoffs, Initiation of Handoff, Delayed Handoff and Forced Handoffs, Mobile Assigned Handoff, Inter-system Handoff, Cell splitting, micro cells, Vehicle locating methods, Dropped Call Rates and their evaluation.

UNIT-VI

DIGITAL CELLULAR NETWORKS: GSM-Introduction to GSM, GSM Architecture, GSM Channel Types and Frame Structure of GSM.

OFDM: Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance. Introduction to Network Technology such as 2G,3G,4G and VoLTE and their advantages.

Text Books

1. Mobile Cellular Telecommunications- William C. Y. Lee , 2nd Edition, Tata McGraw Hill. 2006.
2. Wireless Communication Principles and Practice -Theodore S Rappaport, 2nd Edition, Pearson Education. 2002.

References

1. Wireless and Cellular Communications – William C. Y. Lee , 3rd Edition, Tata McGraw Hill. 2005.
2. Mobile Cellular Communication – G Sasibhushana Rao, Pearson

ELECTRONIC MESUREMENTS AND INSTRUMENTATION	L	T	P	C
	3	1	0	3
IV Year II Semester	Subject Code: **16EC8T26**			

Course objectives:

The student will study

1. Different types of electronic measuring instruments' working principle, errors, specifications etc.
2. Various types of signal generators, wave analyzers and their working principle.
3. The working principles of different types of CRO's.
4. Working principles of various bridges and the measurement of inductance, capacitance and frequency.
5. Active and passive transducers.
6. Measuring physical parameters using transducers.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Illustrate the concepts of indicating instruments for the voltage and current measurements	Applying
CO2	select and use different analyzers and ocsillators to make and analyze measurements	Analyzing
CO3	Use oscilloscope to determine frequency and phase of sinusoidal signal	Understanding
CO4	compare and measurement of different bridge circuits	Analyzing
CO5	understand different transducers principles and their working	Understanding
CO6	measurement of different physical parameters	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	3	-	1	-	-	-	-	-	-	-	-	-	3	2
CO-2	2	-	-	-	-	-	-	-	-	-	-	-	1	2
CO-3	3	-	-	-	-	-	-	-	-	-	-	-	1	2
CO-4	2	-	-	-	-	-	-	-	-	-	-	-	2	2
CO-5	2	-	2	-	-	-	-	-	-	-	-	-	2	2
CO-6	2	-	2	-	-	-	-	-	-	-	-	-	1	2

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/Solid state and differential voltmeters, AC voltmeters- AC Voltmeters Using Rectifiers, True RMS voltmeter multi range, range extension, Thermocouple type RF ammeter, Ohm meters series type, shunt type, Multimeter for Voltage, Current and resistance measurements.

UNIT-II

SIGNAL GENERATORS: Fixed and variable AF oscillators, AF sine and square wave signal generators, Function Generators, Pulse generator, Random noise generator, Sweep generator.

Wave Analyzers: Frequency selective wave analyzer, Harmonic Distortion Analyzers, Spectrum Analyzers, Digital Fourier Analyzers.

UNIT-III

OSCILLOSCOPES: CRT features, Vertical amplifiers, Horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, Dual beam CRO, Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital readout oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement, standard specifications of CRO, probes for CRO- Active and Passive, attenuator type.

UNIT-IV

AC BRIDGES: Measurement of inductance- Maxwell's bridge, Anderson bridge. Measurement of capacitance -Schearing Bridge. Wheatstone bridge, Wien Bridge. Errors and precautions in using bridges, Q-meter.

UNIT-V

TRANSDUCERS: Active and passive transducers - Resistance, Capacitance, Inductance, Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors.

UNIT-VI

MEASUREMENT OF PHYSICAL PARAMETERS: Strain, Load, Force, Pressure, Velocity, humidity, moisture, speed, proximity and displacement, Data acquisition systems.

Text books

1. Electronic instrumentation - H.S.Kalsi, 2nd Edition, Tata McGraw Hill, 2004.

2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, 5th Edition, PHI, 2002.

References

1. Electronic Instrumentation and Measurements - David A. Bell, 2nd Edition PHI, 2003.
2. Electronic Test Instruments, Analog and Digital Measurements - Robert A.Witte, 2nd Edition, Pearson Education., 2004.
3. Electrical Measurements and Measuring Instruments- R.K.Rajput, S.Chand publications, 2008

Web links

www.nptel.ac.in/courses/108105064

SATELLITE COMMUNICATIONS	L	T	P	C
	3	1	0	3
IV Year II Semester	Subject Code: 16EC8T27			

Course Objectives

The student will study

1. The basic concepts, applications, frequencies used in satellite communications.
2. The various satellite subsystems and its functionality.
3. The concepts of satellite link design and calculation of C/N ratio.
4. The concepts of multiple access and various types of multiple access techniques in satellite systems.
5. The transmitters, receivers, antennas, tracking systems of satellite.
6. The concepts of satellite navigation, architecture and applications of GPS

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Understand the basic principles of satellite systems	Understand
CO2	Analyze Satellite subsystems	Understand
CO3	Design the link budget of a satellite for specified C/N ratios	Analyze
CO4	Configure the satellite multiple access techniques	Understand
CO5	Know the concepts of satellite earth station technologies	Understand
CO6	Analyze the satellite navigation and GPS	Understand

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	-	1	1	2	1	-	-	-	-	-	-	-
CO2	1	-	-	2	2	2	2	-	-	-	-	-	-	-
CO3	-	-	2	2	2	2	1	-	-	-	-	-	-	-
CO4	1	1	1	2	3	2	1	-	-	-	-	-	-	-
CO5	1	1	1	1	3	2	1	-	-	-	-	-	-	1
CO6	1	1	1	1	2	1	1	-	-	-	-	-	-	1

UNIT-I

INTRODUCTION : Origin of Satellite Communications, 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.

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.

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.

UNIT-IV

MULTIPLE ACCESS: Frequency division multiple access (FDMA) Intermediation, 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, PN Sequence, Direct Sequence and Frequency Hopped Spread Spectrum System.

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 and Throughput considerations, System considerations, Operational NGSO constellation Designs.

UNIT-VI

SATELLITE NAVIGATION AND THE GLOBAL POSITIONING SYSTEM: Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPS Navigation Message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.

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.

References

1.Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004

2. Satellite Communications : Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.

3. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Edition.

Web links

www.nptelvideos.in/2012/12/ Satellite Communications.html

Elective III

WIRELESS SENSORS AND ACTUATOR NETWORKS	L	T	P	C
	3	1	0	3
IV Year II Semester	Subject Code: **16EC8D07**			

Course objectives

The student will study

1. Mobile Ad Hoc Networks, Implementation Issues and available Solutions.
2. Routing Mechanism approaches in network technology.
3. Clustering Mechanisms and different schemes.
4. 802.11 Wireless LAN (Wi-Fi) and Bluetooth Standards.
5. Sensor Networks and Their Characteristics.
6. The security in Ad Hoc wireless networks and applications of WSN.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME	BTL
CO1	Understand and explain common wireless sensor node architecture and basics of WSN	Understanding
CO2	Analyze basic network topologies	Analyzing
CO3	Demonstrate knowledge of MAC protocols developed for WSN	Knowledge
CO4	Exhibit knowledge of routing protocols developed for WSN	Knowledge
CO5	Understand the designing of transport layer protocol & security protocols	Understanding
CO6	Be familiar with security issues and real time applications of WSN	Applying

The Mapping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

	PO												PSO	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	3	-	2	-	1	-	-	-	-	-	-	-	2	-
CO-2	1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-3	-	-	2	-	-	-	-	-	-	-	-	-	2	-
CO-4	-	-	2	-	-	-	-	-	-	-	-	-	2	-
CO-5	1	-	2	1	-	-	-	-	-	-	-	-	1	-
CO-6	-	-	3	2	-	-	-	-	-	-	-	2	2	-

UNIT-I

OVERVIEW OF WIRELESS SENSOR NETWORKS: Definitions of sensor networks, Advantages of sensor Networks, Unique constraints an challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks.

ARCHITECTURES: Single-Node Architecture - Hardware Components, Energy Consumption of Sensor nodes, operating systems and Execution Environments Network Architecture -Sensor Network Scenarios, Optimization goals and Figures of Merit, Gateway Concepts.

UNIT-II

NETWORKING TECHNOLOGIES- Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs.

UNIT-III

MAC PROTOCOLS FOR WIRELESS SENSOR NETWORKS: Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC protocol for Ad-hoc network Wireless Networks, Classifications of MAC Protocols, Contention – Based protocols, Contention-Based protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC protocol that use Directional Antennas, Other MAC Protocols.

UNIT-IV

ROUTING PROTOCOLS: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless networks, Classification of routing Protocols, Table –Driven Routing Protocols, On – Demand Routing protocols, Hybrid Routing protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing protocols, Power-Aware Routing protocols, Proactive Routing.

UNIT-V

TRANSPORT LAYER AND SECURITY PROTOCOLS: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer solutions, TCP over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT-VI

SECURITY IN WSNs: Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

SENSOR NETWORK PLATFORMS AND TOOLS: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

APPLICATIONS of WSN: S Ultra wide band radio communication Wireless fidelity systems Future directions, Home automation, smart metering Applications

Textbooks

1. Protocols And Architectures for Wireless Sensor networks -Holger Karl and Andreas Willig, John Wiley,2005.
2. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, PHI, 2004.
3. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control – Jagannathan Sarangapani,CRC Press.

References

1. Wireless Sensor Networks- Technology, Protocols, and, Applications - Kazem Sohraby, Daniel Minoli, and Taieb Znati, , John Wiley,2007.
2. Wireless Sensor Networks- An Information processing Approach-Feng Zhao and Leonidas J. Guibas, , Elsevier,2007.
3. Ad- Hoc Mobile Wireless Networks: Protocols and Systems- C.K. Toh ,1st edition, Pearson education.

DIGITAL IC DESIGN	L	T	P	C
	3	1	0	3
IV Year II Semester	Subject Code: **16EC8D08**			

Course objectives

The student will

1. Study the static and dynamic characteristics of inverter using NMOS and CMOS.
2. Study Logic gates and design Combinational logic circuits (i.e) AOI, OAI etc.
3. Implement Sequential logic Circuits like latches and flip-flops using CMOS transmission gates.
4. Study dynamic logic circuits.
5. Study about interconnect parameters of MOS circuits.
6. Study concept of Semiconductor Memories, Flash Memory and RAM array organization.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME
CO-1	Acquire the design principles of inverter using NMOS and CMOS
CO-2	Design Combinational logic Circuits using CMOS transmission gates
CO-3	Design Sequential logic Circuits like latches and flip-flops using CMOS transmission gates
CO-4	Design Dynamic CMOS logic Circuits
CO-5	Know the basic parameters of Interconnect system for design aspects
CO-6	Acquire the knowledge of Semiconductor Memories and organization RAM array

The Maping of CO and PO on 3 point scale{high-3,Medium-2,Low-1}is:

CO#	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO-2	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO-3	1	1	1	-	-	-	-	-	-	-	-	-	-	-
CO-4	2	1	1	-	-	-	-	-	-	-	-	-	2	-
CO-5	1	-	1	1	-	-	-	-	-	-	-	-	-	-
CO-6	1	2	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-I

MOS DESIGN: Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT-II

COMBINATIONAL MOS LOGIC CIRCUITS: MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR and NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates, AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates.

UNIT-III

SEQUENTIAL MOS LOGIC CIRCUITS: Behavior of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

UNIT-IV

DYNAMIC LOGIC CIRCUITS: Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.

UNIT-V

INTERCONNECT: Capacitive Parasitics, Resistive Parasitics, Inductive Parasitics, Advanced Interconnect Techniques.

UNIT-VI

SEMICONDUCTOR MEMORIES: Memory Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory NOR flash and NAND flash.

Text Books

1. Digital Integrated Circuits – A Design Perspective- Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, PHI ,2nd Edition.
2. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.

References

1. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Edition, 2011.
2. CMOS VLSI Design – Neil H.E Weste, David harris, Ayan Banerjee, Pearson, 3rd Edition.

Web links

http://www.nptelvideos.in/2012/12/digital-vlsi-system-design.html

WEB TECHNOLOGIES	L	T	P	C
	3	1	0	3
IV Year II Semester	Subject Code: **16IT8D19**			

COURSE OBJECTIVES:

1. This course is designed to introduce students with no programming experience to the programming languages and techniques associated with the World Wide Web.
2. The course will introduce web-based media-rich programming tools for creating interactive web pages.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME
CO-1	Analyze a web page and identify its elements and attributes
CO-2	Develop client side manipulations in web pages using Java Script
CO-3	Write simple scripts using AJAX and compare DOM & SAX XML Parsers
CO-4	Build web applications using PHP
CO-5	Implement programming through PERL
CO-6	Create applications by using Ruby

Mapping of COs, POs/PSOs:

	PO												PSO	
CO#	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO.1	1	-	2	-	-	-	-	-	-	-	-	-	-	-
CO.2	1	2	2	2	-	-	-	-	-	-	-	-	-	-
CO.3	1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO.4	1	2	2	2	-	-	-	-	-	-	-	-	-	-
CO.5	1	-	2	-	-	-	-	-	-	-	-	-	-	-
CO.6	1	2	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-I: HTML, CSS

Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5

CSS: Levels of Style Sheets, Style Specification Formats, Selector Forms, the Box Model

UNIT-II:

JavaScript

The Basic of Javascript: Objects, Primitives Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions.

UNIT-III:

XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches,

AJAX A New Approach: Introduction to AJAX, Integrating PHP and AJAX.

Web Services: SOAP, WSDL

UNIT-IV:

PHP Programming: Introducing PHP: Creating PHP script, Running PHP script.

Working with variables and constants: Using variables, Using constants, Data types, Operators. Controlling program flow: Conditional statements, Control statements, Arrays, functions. Working with forms and Databases such as MySQL.

UNIT-V:

Introduction to PERL, Operators and if statements, Program design and control structures, Arrays, Hashes and File handling, Regular expressions, Subroutines, Retrieving documents from the web with Perl.

UNIT-VI:

Introduction to Ruby, Variables, types, simple I/O, Control, Arrays, Hashes, Methods, Classes, Iterators, Pattern Matching. Overview of Rails.

TEXT BOOKS:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. The Web Warrior Guide to Web Programming, Bai, Ekedahl, Farrelll, Gosselin, Zak, Karparhi, Maclntyre, Morrissey, Cengage

REFERENCE BOOKS:

1. Ruby on Rails Up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006)
2. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012)
3. Web Technologies, HTML< JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
4. 4. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
5. http://www.upriss.org.uk/perl/PerlCourse.html

WEB LINKS:

1. https://www.w3schools.com/html/html_lists.asp
2. https://www.w3schools.com/xml/
3. www.tutorialspoint.com/ajax/

PYTHON	L	T	P	C
	3	1	0	3
IV Year II Semester	Subject Code: **16IT8D20**			

COURSE OBJECTIVES:

1. To make the students understand the fundamentals of python programming.
2. To expose the students to object oriented concepts.
3. To make the students to develop applications using python.
4. To make students to use python for automation.

Course Outcomes:

The student will be able to

CO	COURSE OUTCOME
CO1	Understand various data types, operators in Python
CO2	Write programs using loop and branch statements to manipulate data in files
CO3	Perform string manipulations
CO4	Perform list and dictionaries operations in python
CO5	Understand the concept of modular programming using functions
CO6	Realize the ease of developing complex programs with smaller sized programs

Mapping of COs, POs/PSOs:

CO#	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	1	-	2	-	-	-	-	-	-	-	-	-	-	-
CO-2	1	2	2	2	-	-	-	-	-	-	-	-	-	-
CO-3	1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO-4	1	2	2	2	-	-	-	-	-	-	-	-	-	-
CO-5	1	-	2	-	-	-	-	-	-	-	-	-	-	-
CO-6	1	2	-	-	-	-	-	-	-	-	-	-	-	-

UNIT I:

Introduction to Python, Installing Python: Basic syntax, interactive shell, editing, saving, and running a script. The concept of data types variables, assignments immutable variables numerical types; arithmetic operators and expressions comments in the program understanding error messages.

UNIT II:

Conditions, Boolean logic, logical operators; ranges: Control statements: If-else, loops (for, while) short-circuit (lazy) evaluation, Strings and text files manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file creating and reading a formatted file (csv or tab-separated).

UNIT III:

String manipulations: Subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers, Lists, tuples, and dictionaries.

UNIT IV:

Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

UNIT V:

Design with functions: Hiding redundancy, complexity; arguments and return values; formal vs. Actual arguments, named arguments, Program structure and design, Recursive functions.

UNIT VI:

Classes and OOP: Classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects, inheritance, polymorphism, operator overloading (eq_, _str_, etc) abstract classes; exception handling, try block, Multithreading, Automation using Python.

TEXT BOOK:

1. Think Python, How to Think Like a Computer Scientist, Version 2.0.17, Allen Downey, Green Tea Press.

REFERENCE BOOKS:

1. Python Essential Reference, David M. Beazley , Pearson Education, Inc.
2. Fluent Python, Luciano Ramalho by O'Reilly Media
3. Python Cookbook, David Beazley and Brian K. Jones, O'Reilly Atlas.3e
4. Fundamentals of Python: First Programs, Kenneth Lambert, Course Technology, Cengage Learning, 2012. ISBN-13: 978-1-111-82270-5.

WEB LINKS:

1. Think Python: How to Think Like a Computer Scientist by Allen B. Downey http://www.greenteapress.com/thinkpython/thinkpython.html
2. Dive into Python by Mark Pilgrim- http://www.diveintopython.nethttp://staff.washington.edu/jon/python-course/

3. https://wiki.python.org/moin/PythonBooks