R19-ACADEMIC REGULATIONS

FOR
B.TECH FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2019-20)

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.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

R19-ACADEMIC REGULATIONS FOR B.TECH (REGULAR)

Applicable for the students of B.Tech (Regular) Admitted from the academic year 2019-2020.

1. AWARD OF B.TECH DEGREE

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

1.1 A Student shall be declared eligible for the award of the B.Tech Degree, if he/she 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 160 credits and secure all the 160 credits.

2. PROGRAMMES OF STUDY

Following B.Tech Programmes are offered with English as medium of instruction.

S. No.	Name of the Programme	Code
1	Civil Engineering (CE)	01
2	Electrical and Electronics Engineering (EEE)	02
3	Mechanical Engineering (ME)	03
4	Electronics and Communications Engineering (ECE)	04
5	Computer Science and Engineering (CSE)	05
6	Information Technology (IT)	12

3. INDUCTION PROGRAMME.

At the beginning of the first year in the zero semester there shall be three weeks induction programme to help new students adjust and feel comfortable in the new environment, inculcate in them the culture of the institution.

4. DISTRIBUTION AND WEIGHTAGE OF MARKS

4.1 The performance of a student in each semester shall be evaluated subject – wise with a maximum of 100 marks for theory/drawing/design courses and 75 marks for laboratory courses. The project work shall be evaluated for 200 marks. The mini project/Socially relevant activity has a weightage of 50 marks and evaluated internally.

4.2 Theory Courses

a) Internal assessment : 30 marks

For the Mid examinations there shall be two tests, one conducted in the middle and the other at the end of each semester. Each mid examination consists of an examination and assignment. The question paper contains **Part-A** and **Part-B**. The duration for the answering the question paper is 100 minutes. For first Mid examination Part-A consists

of three questions, one question from first unit, one question from second unit each for 8 marks and one question from first half of third unit for 4 marks. For second Mid examination Part-A consists of three questions, one question from second half of third unit for 4 marks, one question from fourth unit and one question from fifth unit each for 8 marks. Part-B consists of ten objective type questions each carries half mark totaling to 5 marks. Answering all questions is compulsory.

Students shall submit two assignments in a semester. The first assignment will be on first two units and first half of the third unit. The second assignment will be on the second half of third unit and last two units. The marks allotted for each assignment is 5.

Internal Marks based on mid examinations including assignments (30 Marks) are calculated with 80% weightage for best of the two mid examinations and 20% weightage for other mid examination.

The formula for finding the total marks of internal assessment (30 marks) =[0.80 x higher marks scored between the two internal tests + 0.20 x marks scored in the other test]

b) External assessment: 70 Marks

The end semester examination is of 3 hours duration and it covers the topics in 5 units and weightage is 70 marks.

End examination consists of 5 questions and each question for 14 marks. Two Questions from each unit with internal choice i.e, either or choice (total 10 questions with 2 questions from each unit)

4.3 Laboratory Courses

a) Internal assessment : 25 marks

There shall be continuous evaluation during the semester for 25 marks as shown below:

Day-to-Day work	-	10 marks
Laboratory record	-	5 marks
One internal test at the end of the semester	-	10 marks
Total	-	**25 Marks**

b) External Assessment : 50 marks

At the end of the semester an examination for 3 hours duration shall be conducted for 50 marks by the concerned teacher and an external examiner.

4.4 Drawing/Similar Course

i) For Engineering Drawing course,

a) Internal assessment : 30 marks

There shall be continuous evaluation with a weightage of 30 marks as shown below :

Day-to-Day work	-	15 marks
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.	-	15 marks
Total	-	**30 Marks**

b) External assessment : 70 Marks

Same as for theory courses given in 4.2 (b)

ii) For Machine Drawing course,

a) Internal assessment : 30 marks

There shall be continuous evaluation with a weightage of 30 marks as shown below :

Day-to-Day work	-	15 marks
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.	-	15 marks
Total	-	**30 Marks**

b) External assessment : 70 Marks

The end semester examination is of 3 hours duration and it covers the topics in two parts and weightage is 70 marks.

End examination consists of two parts i.e PART-A and PART-B. PART-A consists of 3 questions and out of which two questions are to be answered and each carries 14 marks. PART-B contains one compulsory question for 42 marks.

iii) Courses such as Building Planning and Drawing, Design and Detailing of Reinforced Concrete Structures, Design and Detailing of Steel Structures, Estimation, Specifications and Contracts.

a) Internal assessment : 30 marks

There shall be continuous evaluation with a weightage of 30 marks as shown below :

Assignments	-	10 marks
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	-	**30 Marks**

b) External assessment : 70 Marks

The end semester examination is of 3 hours duration and it covers the topics in 5 units and weightage is 70 marks.

End examination consists of two parts i.e PART-A and PART-B. PART-A consists of 2 questions and out of which one question has to be answered and carries 28 marks. PART-B contains 5 Questions out of which three questions has to be answered and each carries 14 marks.

4.5 Socially Relevant Activity

To enhance social responsibility among students a Socially relevant Activity is introduced in the II year I / II semester. Each student has to participate in various social awareness programmes viz. Swach Bharat, Water Harvesting, Health and Hygiene. Each student has to work 15 hours continuously in the semester for this work. It has a weightage of 50 marks and evaluated internally at the end of the semester.

4.6 Mini Project

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

4.7 Project Work

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.

4.8 Mandatory Audit/Non Credit Courses

Following are the mandatory audit courses offered to all the programmes.

i. Environmental Science
ii. Constitution of India
iii. Essence of Indian Traditional Knowledge
iv. Professional Ethics and Human Values
v. IPR and Patents
vi. MOOCs/Industry course approved by the department.

4.8.1 Evaluation Procedure:

4.8.1.1 Mandatory Audit/Non Credit Courses (i - v):

For the Mandatory Audit/Non credit courses i-v listed above an internal test shall be conducted at the end of the semester. A student is required to score minimum 40 marks out of 100 marks in each of the mandatory audit/non credit courses.

4.8.1.2 MOOCs Course/ industry course approved by the department::

A student shall register either MOOCs or industry course approved by the department.

i. MOOCs:

There shall be a Discipline Centric mandatory Course through Massive Open Online Course (MOOC). The student shall register for the course (Minimum of 8 weeks) offered by authorized Institutions/Agencies through online with the approval of Head of the Department which is not covered in the curriculum,. For those students who have not cleared the online MOOCs course, respective Head of the Department shall appoint one mentor for each of the MOOC subjects offered and the mentor appointed shall conduct an internal test. A student is required to score 40 marks out of 100 marks.

ii. Industry course approved by the department:

For the industry course an industry trained faculty member nominated by the Head of the department shall conduct a course during the semester. At the end of the semester an internal test shall be conducted. A student is required to score 40 marks out of 100 marks.

The B.Tech degree shall only be awarded if a student gets satisfactory grade (CS-Completed Successfully) in each of the mandatory audit/non credit courses besides acquiring 160 (120 for lateral entry) credits.

5. ATTENDANCE REQUIREMENTS :

5.1 A student shall be eligible to appear for semester end examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.
5.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.
5.3 Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
5.4 A stipulated fee shall be payable towards condonation of shortage of attendance to the College.
5.5 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester and their registration shall stand cancelled.
5.6 A student will not be promoted to the next semester unless he/she satisfies the attendance requirements of the present semester. They may seek readmission for that semester when offered next.

6. MINIMUM ACADEMIC REQUIREMENTS

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned under rule 5.0.

5.1 A Student is deemed to have satisfied the minimum academic requirements if he has **earned the credits allotted to each theory/laboratory, design/drawing subject/project 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.

5.2 A student shall register and put in minimum attendance in all 160 credits and earn all 160 credits.

7. PROGRAMME PATTERN

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

5.4 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.

5.5 When a student is detained due to 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.

8. PROMOTION TO NEXT HIGHER CLASS

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

5.7 A Student shall be **promoted from II year to III year**, if he fulfills the academic requirement of **50% of the credits up to 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.**

5.8 A student shall be **promoted from III year to IV year** if he fulfills the academic requirements of **50% of the credits up to 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.**

9. CUMULATIVE GRADE POINT AVERAGE (CGPA)

Theory/Laboratory Design/Drawing/Project work/mini project/socially relevant activity (%)	Letter Grade	Level	Grade Point
≥ 90	O	Outstanding	10
≥ 80 to < 90	S	Excellent	9
≥ 70 to < 80	A	Very Good	8
≥ 60 to < 70	B	Good	7
≥ 50 to < 60	C	Fair	6
≥ 40 to < 50	D	Satisfactory	5
<40	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 ith course and Gi is the grade point scored by the student in the ith 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 ith 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

10. 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	**From the CGPA secured from 160 credits**
First Class	≥ 6.75 to < 7.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 4.75 to < 5.75	

11. MINIMUM INSTRUCTIONS DAYS.

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

12. STUDENT TRANSFERS

12.1 There shall be no branch transfers after the completion of the admission process.
12.2 Pragati Engineering College (Autonomous) follows the practice of JNTUK/ State Government guidelines for transfer of students.

13. TRANSITORY REGULATIONS

13.1 Discontinued or Detained Students are eligible for readmission as and when next offered. The readmitted students will be governed by the regulations under which the student has been admitted.

13.2 a) In case of transferred students from other universities/colleges, the credits shall be transferred to Pragati Engineering College (Autonomous) R19 Academic Regulations and course structure of the respective discipline.

b) The students seeking transfer to Pragati Engineering College (Autonomous) from other universities/institutions have to obtain the credits of equivalent courses as prescribed by the college. In addition the transferred students have to pass the courses in which they failed at the earlier institute.

14. GENERAL :

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

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

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

14.4 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.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

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 2020-21.

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 120 credits and secure all the 120 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 III year to IV year** if he fulfills the academic requirements of **50% of the credits up to 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	**From the CGPA secured from 120 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.**

MALPRACTIES RULES

The rules laid down in JNTUK R19 regulations will be followed in toto.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

Ragging

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 and 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/-

LET US MAKE PRAGATI RAGGING FREE COLLEGE

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

Ragging

ABSOLUTELY NO 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.**

LET US MAKE PRAGATI RAGGING FREE COLLEGE

COURSE STRUCTURE & SYLLABUS

For

B.Tech.

ELECTRONICS AND COMMUNICATION ENGINEERING

(*Applicable for batches admitted from 2019-20*)

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Permanently Affiliated to JNTUK, Kakinada, Accredited by NAAC with "A" Grade
Recognized by UGC 2(f) and 12(b) under UGC act, 1956
1-378, ADB Road, Surampalem – 533 437
Near Peddapuram, E.G.Dist, Andhra Pradesh

Semester – 0
3 weeks Induction Program to be conducted at the beginning of the first year

Zero Semester

Induction program (mandatory)	**3 weeks duration**
Induction program for students to be offered at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch and Innovations

I Year – I Semester

S.No.	Category	Subject Code	Subjects	L	T	P	C
1	Basic Science	19BM1T01	Linear Algebra & Differential Equations	3		--	3
2	Engineering Science	19EE1T01	Basic Electrical Engineering	3		--	3
3	Basic Science	19BP1T02	Applied Physics	3		--	3
4	Humanities	19HE1T01	Professional Communicative English	3		--	3
5	Engineering Science	19CS1T01	Programming for Problem Solving using C	3		--	3
6	Humanities	19HE1L01	Professional Communicative English – Laboratory- I	--	--	2	1
7	Basic Science	19BP1L02	Applied Physics Lab	--	--	3	1.5
8	Engineering Science	19CS1L01	Programming for Problem Solving using C Lab	--	--	3	1.5
9	Mandatory course	19HM1T05	Constitution of India	2	--	--	--
Total credits							**19**

I Year – II Semester

S.No.	Category	Subject Code	Subjects	L	T	P	C
1	Basic Science	19BM2T02	Numerical Methods and Multivariable calculus	3		--	3
2	Basic Science	19BM2T03	Integral Transforms and vector calculus	3		--	3
3	Basic Science	19BC2T02	Applied Chemistry	3		--	3
4	Professional Core	192C2T01	Network Analysis	3		--	3
5	Professional Core	19EC2T02	Electronic Devices and Circuits	3	--	--	3
6	Engineering Science	19ME2T01	Engineering Drawing	1		3	2.5
7	Basic Science	19BC2L02	Applied Chemistry Lab	--	--	3	1.5
8	Humanities	19HE2L02	Professional Communicative English – Laboratory- II	--	--	2	1
9	Professional Core	19EC2L01	Electronic Workshop	--	--	2	1
10	Mandatory course	19BE2T01	Environmental Studies	2	--	--	0
Total credits							**21**

II Year – I Semester

S.No.	Category	Subject Code	Subjects	L	T	P	C
1	Professional Core	19EC3T04	Switching Theory and Logic Design	3	--	--	3
2	Professional Core	19EC3T07	Control Systems	3	--	--	3
3	Professional Core	19EC3T08	Signals and Systems	3	--	--	3
4	Engineering Science	19EC3T10	Internet of Things	3	--	--	3
5	Humanities	19HM3T01	Managerial Economics & Financial Analysis	3	--	--	3
6	Engineering Science	19EE3L01	Basic Electrical Engineering Lab	--	--	3	1.5
7	Professional Core	19EC3L02	Electronic Devices and Circuits Lab	--	--	3	1.5
8	Professional Core	19EC3T03	Switching Theory and Logic Design Lab	--	--	3	1.5
9	Mandatory course	19HM3T06	Essence of Indian Traditional Knowledge	2	--	--	0
Total credits							**19.5**

II Year – II Semester

S.No.	Category	Subject Code	Subjects	L	T	P	C
1	Professional Core	19EC4T11	Electronic Circuit Analysis	3	--	--	3
2	Professional Core	19EC4T12	Random Variables and Stochastic Process	3	--	--	3
3	Professional Core	19EC4T13	Electromagnetic Waves and Transmission Lines	3	--	--	3
4	Professional Core	19EC4T14	Analog Communications	3	--	--	3
5	Professional Core	19EC4T15	Computer Architecture & Organization	3	--	--	3
6	Engineering Science	19CS4T05	Object Oriented Programming	3	--	--	3
7	Professional Core	19EC4L04	Electronic Circuit Analysis Lab	--	--	3	1.5
8	Professional Core	19EC4L05	Analog Communications Lab	--	--	3	1.5
9	Project	19EC4P01	Socially Relevant Project*	--	--	--	0.5
10	Humanities	19HM4T07	Professional Ethics & Human Values	2	--	--	0
Total credits							**21.5**

***15hrs per semester**

III Year – I Semester

S.No.	Category	Subject Code	Subjects	L	T	P	C
1	Professional Core	19EC5T16	Integrated Circuits & Applications	3	--	--	3
2	Professional Core	19EC5T21	Digital Communications	3	--	--	3
3	Professional Core	19EC5T22	Antennas and Propagation	3	--	--	3
4	Professional Core	19EC5T18	Microprocessors & Microcontrollers	3	--	--	3
5	Engineering Science	19IT5T06	Operating Systems	3	--	--	3
6	Program Elective		**Professional Elective-I**	3	--	--	3
7	Professional Core	19EC5L06	Integrated Circuits & Applications Lab	--	--	3	1.5
8	Professional Core	19EC5L08	Digital Communications Lab	--	--	3	1.5
9	Professional Core	19EC5L09	Microprocessors & Microcontrollers Lab	--	--	3	1.5
10	Humanities	19HM5T08	IPR & Patents	2	--	--	0
Total credits							**22.5**

III Year – II Semester

S.No.	Category	Subject Code	Subjects	L	T	P	C
1	Professional Core	19EC6T27	Digital Signal Processing	3	--	--	3
2	Professional Core	19EC6T28	VLSI Design	3	--	--	3
3	Professional Core	19EC6T29	Microwave Engineering	3	--	--	3
4	Program Elective		**Professional Elective-II**	3	--	--	3
5	Open Elective		**OPEN ELECTIVE-I**	3	--	--	3
6	Professional Core	19EC6L12	Digital Signal Processing Lab	--	--	3	1.5
7	Professional Core	19EC6L13	VLSI Lab	--	--	3	1.5
8	Professional Core	19EC6L14	Microwave Engineering Lab	--	--	3	1.5
9	Project	19EC6P02	Mini Project	--	--	2	1
10	Mandatory course	19EC6T52	MOOCs **	3	--	--	0
Total credits							**20.5**

****Student can select the course of any discipline under MOOCs. However, agency will be decided by the respective BoS.**

IV Year – I Semester

S.No.	Category	Subject Code	Subjects	L	T	P	C
1	Professional Core	19EC7T36	Data Communications and Computer Networks	3	--	--	3
2	Professional Core	19EC7T37	Digital Image and Video Processing	3	--	--	3
3	Professional Core	19EC7T38	Electronic Measurements and Instrumentation	3	--	--	3
4	Engineering Science	19CS7T18	AI Tools and Techniques	3	--	--	3
5	Program Elective		**Professional Elective III**	3	--	--	3
6	Professional Core	19EC7L15	Digital Image Processing Lab	--	--	3	1.5
7	Professional Core	19EC7L16	Electronic Measurements and Instrumentation Lab	--	--	3	1.5
Total credits							**18**

IV Year – II Semester

S.No.	Category	Subject Code	Subjects	L	T	P	C
1	Program Elective		**Professional Elective IV**	3	--	--	3
2	Program Elective		**Professional Elective V**	3	--	--	3
3	Open Elective		**OPEN ELECTIVE-II**	3	--	--	3
4	Project	19EC8P03	Project	--	--	18	9
Total credits							**18**

L= Lecture **T=Tutorial** **P=Practical** **C=Credits**

40+41+43+36 =160

Professional Elective-I

S.No.	Subject Code	Subjects	L	T	P	C
1	19EC5T23	Pulse & Digital Circuits	3	--	--	3
2	19EC5T24	Digital System Design	3	--	--	3
3	19EC5T25	Information Theory & Coding	3	--	--	3
4	19EC5T26	Advanced Computer Architecture	3	--	--	3

Professional Elective-II

S.No.	Subject Code	Subjects	L	T	P	C
1	19EC6T30	Embedded Systems	3	--	--	3
2	19EC6T32	Wireless Communications	3	--	--	3
3	19EC6T33	Biomedical Instrumentation	3	--	--	3
4	19EC6T34	Multimedia and Communication	3	--	--	3

Professional Elective-III

S.No.	Subject Code	Subjects	L	T	P	C
1	19EC7T40	CPLD & FPGA Architecture	3	--	--	3
2	19EC7T41	Wireless Sensors and Actuator Networks	3	--	--	3
3	19EC7T42	Digital Signal Processors and Architecture	3	--	--	3
4	19EC7T43	Optical Communication	3	--	--	3

Professional Elective-IV

S.No.	Subject Code	Subjects	L	T	P	C
1	19EC8T44	Analog IC Design	3	--	--	3
2	19EC8T45	System Design through Verilog	3	--	--	3
3	19EC8T46	Satellite Communication	3	--	--	3
4	19EC8T47	Speech Processing	3	--	--	3

Professional Elective-V

S.No.	Subject Code	Subjects	L	T	P	C
1	19EC8T48	Radar Engineering	3	--	--	3
2	19EC8T49	CMOS Digital IC Design	3	--	--	3
3	19EC8T50	4G Mobile Broadband and Small Cell Networks	3	--	--	3
4	19EC8T51	Embedded Networking	3	--	--	3

Open Elective - I

S.no	Name of the subject	Code	Handled department	Year & semester	Credits
1	Waste Water Management	19CE6T24	CIVIL	III-II	3
2	Energy Audit, conservation & Management	19EE6T24	EEE	III-II	3
3	Python Programming	19CS6T03	CSE	III-II	3
4	Industrial Robotics	19ME6T28	MECH	III-II	3
5	Management Science	19HM6T02	BS&H	III-II	3
6	Nuclear Science and Technology	19BP6T03	BS&H	III-II	3

Open Elective - II

1	Traffic Engineering	19CE8T43	CIVIL	IV-II	3
2	Power Electronics	19EE8T12	EEE	IV-II	3
3	Production, Planning and Control	19ME8T44	ME	IV-II	3
4	Cryptography and Network Security	19IT8T08	IT	IV-II	3
5	Entrepreneurship	19HM8T03	BS&H	IV-II	3
6	Material Chemistry and Engineering Applications	19BC8T03	BS&H	IV-II	3

Linear Algebra and Differential Equations

(Common to CE, EEE, ME, ECE, CSE & IT)

I B. Tech I Semester

Course Category	Basic Sciences	**Course Code**	19BM1T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Basics of matrices, Differentiation, Integration	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

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 form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	solve systems of linear equations, determine the rank, find the eigenvalues and eigenvectors, diagonalization of a matrix.	K3
CO2	identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics.	K2
CO3	solve first order differential equations and its applications	K3
CO4	solve the linear differential equations with constant coefficients by appropriate method	K3
CO5	find partial derivatives of multivariable functions and apply them to find extreme values of a function.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Solving system of linear equations, Eigen Values and Eigen vectors** Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss elimination method for solving system of equations – Eigenvalues and Eigen vectors and their properties.

UNIT II	**Cayley-Hamilton Theorem and Quadratic forms** Cayley-Hamilton theorem (without proof) – Finding inverse and powers of a matrix by Cayley-Hamilton theorem – Reduction to diagonal form-Quadratic forms-nature of the quadratic form - reduction of quadratic form to canonical form by orthogonal transformation.
UNIT III	**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 – Orthogonal trajectories.
UNIT IV	**Linear differential equations of higher order** Non-homogeneous equations of higher order with constant coefficients with RHS term of the typee^{ax}, $\sin ax$, $\cos ax$, polynomials in x^n, $e^{ax}V(x)$, $x^mV(x)$ - Method of Variation of parameters.
UNIT V	**Partial differentiation** Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Generalized Mean value theorem for single variable (without proof) – Taylor's and Maclaurin'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.	**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, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
WEB RESOURCES	
1.	**UNIT I: Solving system of linear equations, Eigen Values and Eigen vectors** https://en.wikipedia.org/wiki/System_of_linear_equations https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors
2.	**UNIT II: Cayley-Hamilton Theorem and Quadratic forms** https://www.math.hmc.edu/calculus/tutorials/eigenstuff/ https://en.wikipedia.org/wiki/Quadratic_form
3.	**UNIT III: Differential equations of first order and first degree** https://en.wikipedia.org/wiki/Differential_equation http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode https://www.khanacademy.org/math/differential-equations/first-order-differential-equations
4.	**UNIT IV: Linear differential equations of higher order** https://en.wikipedia.org/wiki/Differential_equation http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode https://nptel.ac.in/courses/122107037/20
5.	**UNIT V: Partial Differentiation** https://en.wikipedia.org/wiki/Partial_derivative https://www.whitman.edu/mathematics/calculus_online/section14.03.html

BASIC ELECTRICAL ENGINEERING

(For B. Tech ECE)

Course Category	Engineering Sciences	**Course Code**	**19EE1T01**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NA	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn the constructional details, operating principle and performance of transformers.
2	To understand the constructional details, operating principle and operational characteristics of Induction machines.
3	To study the constructional details, operating principle of single phase induction motors and synchronous generators.
4	To learn the operating principle and starting methods of synchronous motors.
5	To understand the operating principle, characteristics of DC machines and speed control methods of DC Motors.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the constructional details, operating principle and performance of transformers.	Understanding
CO2	Explain the constructional details, operating principle and operational characteristics of Induction machines.	Understanding
CO3	Explain the constructional details, operating principle of single phase induction motors and synchronous generators.	Understanding
CO4	Explain the operating principle and starting methods of synchronous motors.	Understanding
CO5	Understand the operating principle, characteristics of DC machines and speed control methods of DC Motors.	Understanding

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	0	0	0	0	0	0	0	1	0	0
CO2	3	2	1	1	0	0	0	0	0	0	0	1	0	0
CO3	3	2	1	2	0	0	0	0	0	0	0	1	0	0
CO4	3	2	1	1	0	0	0	0	0	0	0	1	0	0
CO5	3	2	1	1	0	0	0	0	0	0	0	1	0	0

COURSE CONTENT	
UNIT I	**Transformers** Constructional details, operating principle – EMF equation- equivalent circuit – Losses, efficiency and voltage regulation – direct load test, OC & SC tests.
UNIT II	**Induction Machines** Constructional details, operating principle - types – torque-slip characteristics - efficiency - starting methods-Brake test on 3-phase induction motor.
UNIT III	**Single Phase Induction Motor** Constructional details, operating principle - starting methods - shaded pole motor, capacitor start and run motors.

	Synchronous Generators Constructional details, operating principle – types - EMF equation – phasor diagram - voltage regulation by synchronous impedance method.
UNIT IV	**Synchronous motors** Constructional details, operating principle – starting methods.
UNIT V	**DC Machines** Constructional details, operating principle – types – EMF and torque equations – three pointstarter – speed control methods of DC motor – Swinburne's Test- applications.

TEXT BOOKS	
1.	Electric Machinery by A. E. Fitzgerald, Charles Kingsley, Jr. and Stephen D.Umans McGraw-Hill Higher Education, 6th Edition.
2.	Principles of electric machines by V.K.Mehta& Rohit Mehta, S.Chand publications.
3.	Theory and performance of Electrical machines by J.B.Gupta, S.K.Kataria& Sons.
REFERENCE BOOKS	
1.	Basic Electrical Engineering by M.S Naidu and S. Kamakshiah TMH Publications.
2.	Fundamentals of Electrical engineering by Rajendra Prasad, PHI publications, 2nd Edition.
3.	Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd Edition.
4.	Basic Electrical Engineering by D C Kulshreshtha McGraw-Hill Education, revised 1st Edition.
5.	Electrical Technology by B L Theraja&A.K.Theraja, S.Chand publications ,Volume 2
WEB RESOURCES (Suggested)	
1.	https://nptel.ac.in/courses/108106071/pdfs/2_1.pdf
2.	https://nptel.ac.in/courses/108106071/pdfs/1_1.pdf
3.	https://nptel.ac.in/courses/108106072/12
4.	https://nptel.ac.in/courses/108105112/58
5.	https://nptel.ac.in/courses/108105053/34

APPLIED PHYSICS

Common to I-I ECE, CSE & IT

Course Category	BASIC SCIENCES	**Course Code**	**19BP1T02**
Course Type	Theory	**L-T-P-C**	3 -0 -0-3
Prerequisites	Intermediate Physics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Impart Knowledge of Physical Optics phenomena like Interference and Diffraction required to design instruments with higher resolution.
2	Understand the physics of Semiconductors and their working mechanism for their utility in Engineering applications.
3	Impart the knowledge of Dielectric and Magnetic materials with characteristic utility in appliances.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Analyze the optical applications using the concepts of Interference and diffraction.	Analyze (K4)
CO2	Apply the concepts of quantum mechanics for calculation of free quantum particle energies.	Applying (K3)
CO3	Apply the basics of Laser Mechanism and fiber optics for the communications systems.	Applying(K3)
CO4	Understand the electrical conductivities in semiconductors and study the types of semiconductors using Hall Effect.	Understanding(K2)
CO5	Understand the polarization phenomenon in dielectric materials and magnetic materials to study dependence on temperature and frequency response.	Understanding(K2)

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2		1	1										
CO2	2	2		1											
CO3	2	2	1												
CO4	3	2	2									1	1		
CO5	2	1													

COURSE CONTENT	
UNIT I	**WAVE OPTICS (10 hrs)** **INTERFERENCE** Introduction-Principle of Superposition – Coherent Sources – Interference in parallel and non - parallel thin films (reflection geometry), Newton's rings & Applications. **DIFFRACTION** Introduction- Differences between Interference and Diffraction, Differences between Fresnel and

	Fraunhoffer diffraction Fraunhoffer diffraction in single slit (Qualitative), Fraunhoffer diffraction Double slit(Qualitative),Grating equation (analytical Treatment)-Rayleigh criterion of resolution and Resolving power of grating,
UNIT II	**QUANTUM MECHANICS (8hrs)** Introduction – Matter waves – de Broglie's hypothesis – Davisson-Germer experiment – G.P.Thomson experiment – Heisenberg's Uncertainty Principle –interpretation of wave function – Schrödinger Time Independent and Time Dependent wave equations – Particle in a potential box
UNIT III	**LASERS (11 hrs)** Introduction-Characteristics–Spontaneous and Stimulated emission of radiation – population inversion - Pumping Mechanisms - Ruby laser – Helium Neon laser – Semiconductor laser– Applications **FIBER OPTICS:** Introduction- Structure of Optical Fiber – Total Internal Reflection-Numerical Aperture and Acceptance Angle-classification of Optical fibers- optical fiber communication system- Advantages of Optical fibers- Applications.
UNIT IV	**SEMICONDUCTOR PHYSICS (8 hrs)** Introduction–Intrinsic semi conductors - density of charge carriers- Electrical conductivity – Fermi level – extrinsic semiconductors - p-type &n-type - Density of charge carriers -Hall effect- Hall coefficient - Applications of Hall effect
UNIT V	**DIELECTRICS(11 hrs)** Introduction - Dielectic polarization– Dielectric Polarizability, Susceptibility and Dielectric constant- types of polarizations- Electronic Ionic and Orientational polarizations (qualitative) – Lorentz Internal field – Claussius-Mossoti equation -Applications of dielectrics. **MAGNETIC PROPERTIES** Introduction-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability-Origin of permanent magnetic moment -Classification of Magnetic materials(Analytical)--Hysteresis-soft and hard magnetic materials & applications

TEXT BOOKS	
1.	"A Text book of Engineering Physics"byM.N.Avadhanulu, P.G.Kshirsagar -S.Chand Publications,
2.	"Engineering Physics" by M.R.Srinivasan, New Age international publishers.
3.	"Solid State Physics" by SO Pilai., - New age International Publishers
REFERENCE BOOKS	
1.	Kettles Introduction to Solid state Physics-Charles Kittel,Wiley India Edition
2.	Solid State Physics ,AJ Dekker, I Edition,Macmillan Publishers India Private Limited
WEB RESOURCES	
1.	https://youtu.be/NVllY3LlNqc https://youtu.be/1TRdOjVpm-0 https://youtu.be/0tHcWDNCJ-o
2.	https://study.com/academy/lesson/the-de-broglie-hypothesis-definition-significance.html https://www.youtube.com/watch?v=uPvWlwOhCTo
3.	https://www.youtube.com/watch?v=fdS12EaXH3A http://folk.uio.no/ravi/cutn/cmp/band1.pdf
4.	https://www.electronics-tutorials.ws/diode/diode_1.html https://youtu.be/3csUvwZdsOg https://www.youtube.com/watch?v=_40dpUzzfhA
5.	https://youtu.be/TuvLv6SBO5s https://youtu.be/u0Qf9jVh2kc

PROFESSIONAL COMMUNICATIVE ENGLISH

Course Category	HUMANITIES	**Course Code**	**19HE1T01**
Course Type	Theory	**L-T-P-C**	3 -0 -0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

S.NO	COURSE OUTCOME		Cognitive Level
1	CO1	Emphasizes that the ultimate aim of education is to enhance wisdom and inspires the readers to serve their nation with their self-enrichment.	K2
2	CO2	Enables the learners to promote peaceful co-existence and universal harmony in the society and empowers the learners to have initiation in innovation.	K2
3	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 contribute to their nation.	K3
4	CO4	Arouses the thought of life to lead in a good path by recognizing the importance of work besides enhancing their LSRW skills.	K2
5	CO5	Inspires the learners at the advancement of software by the eminent personalities and motivates the readers to think and tap their innate talents.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO1 2	PSO1	PSO2
CO1	1	-	-	-	-	2	1	-	-	1	-	3		
CO2	2	1	-	-	-	1	3	1	-	1	-	1		
CO3	-	-	-	-	-	1	2	-	-	1	-	-		
CO4	-	-	-	-	-	1	-	1	2	-	-	-		
CO5	-	-	1	2	1	-	-	-	-	1	-	-		

Introduction:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training the studentsto 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 is 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 ideas.

Objectives:

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

LISTENING SKILLS

Objectives:

1. To enable the learners to appreciate the role of listening skill and improve their pronunciation.

2. To enable the learners to comprehend the speech prescribe of people belonging to different backgrounds and regions.
3. To enable the learners to listen for general content, to fill up information and infer the content.

SPEAKING SKILLS

Objectives:

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

READING SKILLS

Objectives:

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

WRITING SKILLS

Objectives:

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

Methodology:

1. The classes are to be learning-centred where the learners participate in the language learning activities with the peer group and the facilitator.
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 animated with the help of learning positive activities such as pair work, Group Discussion and so on.
4. The facilitator is expected to use supplementary material wherever necessary and also generate activities/tasks as per the requirement.
5. The facilitatoractivities the learning in a particular mode.

The following text books are recommended for study in I B.Tech I Semester (Common for all branches) of Pragati Engineering College, Surampalem from the academic year 2019-20 (R-19 Regulations)

DETAILED TEXTBOOK:

- **PROFESSIONAL COMMUNICATIVE ENGLISH***Published by Maruthi Publishers.*

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 1:

1. *'The Greatest Resource- Education' from Professional Communicative English.*
   Objective: Schumacher describes the education system by saying that it was mere training, something more than knowledge of facts.
   Outcome: Underscores that the ultimate aim of Education is to enhance wisdom.

2. 'War' from 'Panorama: A Course on Reading'
   Objective: To develop extensive reading skill and comprehension for pleasure and profit.
   Outcome: Acquisition of LSRW skills

UNIT 2:

1. ' A Dilemma' from Professional Communicative English.
   Objective: The lesson centers on the pros and cons of the development of science and technology.
   Outcome: Enables the students to promote peaceful co-existence and universal harmony among people in the society.

2.'The Verger' from 'Panorama: A Course on Reading'
   Objective:To develop extensive reading skill and comprehension for pleasure and profit.
   Outcome: Acquisition of LSRW skills

UNIT 3:

1. 'Cultural Shock': Adjustments to new Cultural Environments from Professional Communicative English.
   Objective: Depicts of the symptoms of Cultural Shock and the aftermath consequences
   Outcome: Enables the students to manage different cultural shocks due to globalization.

2. ' The Scarecrow' from Panorama: A Course on Reading
   Objective: To develop extensive reading skill and comprehension for pleasure and profit.
   Outcome: Acquisition of LSRW skills

UNIT 4:

1. *'The Secret of Work'* from *Professional Communicative English.*
   Objective: Portrays the ways of living life in its true sense.
   Outcome: Arouses the thoughtto lead life in a good path by recognizing the importance of work.
2. *'A Village Lost to the Nation' from Panorama: A Course on Reading*
   Objective: To develop extensive reading skill and comprehension for pleasure and profit.
   Outcome: Acquisition of LSRW skills

UNIT 5:

1. ' The Chief Software Architect' from Professional Communicative English.
   Objective: Supports the developments of technology for the betterment of human life.

   Outcome: Pupil gets inspired by eminent personalities who toiled for the present day advancement of software development.

2. 'Martin Luther King and Africa' from Panorama: A Course on Reading
   Objective: To develop extensive reading skill and comprehension for pleasure and profit.

   Outcome: Acquisition of LSRW skills

Programming for Problem solving using C

(Common to CE, ME, EEE, ECE, CSE, IT)

Course Category	Engineering Science	**Course Code**	19CS1T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To impart adequate knowledge on the need of programming languages and problem solving techniques.
2	To develop programming skills using the fundamentals of C Language.
3	To enable effective usage of arrays, structures, functions, pointers and dynamic memory allocation.
4	To make use of file handling functions in programming.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Apply the fundamentals of C Programming for Problem solving.	L3
CO2	Identify the appropriate Decision statement and Loops for a given Problem.	L2
CO3	Make use of Arrays and Strings to solve the problems in C.	L3
CO4	Apply the concepts of Functions and Pointers in Problem solving.	L3
CO5	Develop solutions for problems using Structures, Unions and Files.	L3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	0	0	0	0	0	0	0	1	1	0
CO2	3	3	3	3	1	0	0	0	0	0	0	0	1	1	0
CO3	3	3	3	2	1	0	0	0	0	0	0	0	2	1	0
CO4	2	3	3	3	1	0	0	0	0	0	0	0	2	2	0
CO5	3	3	3	3	1	0	0	0	0	0	0	0	2	2	0

COURSE CONTENT	
UNIT I	**Introduction to Programming**–Introduction to Computer Software, Classification of Computer Software, Representation of Data – Bits and Bytes, Programming Languages – High and Low Level Languages, Generation of Programming Languages, Program Design Tools: Algorithms, Flowcharts, Pseudocode, Types of Errors, Testing & Debugging Approaches. **Introduction to C –** Structure of a C Program, Writing the First C Program, Header Files used in C Program, Compiling and Executing C Programs.
UNIT II	**Tokens in C:** Basic Data Types in C – Keywords, Identifiers, Variables, Constants, Input / Output statements in C, Operators in C, Precedence and Associativity Rules, Type Casting Types. **Decision Control**: Decision Control Statements: Conditional Branching Statements - if, if – else, nested if, if – else – if, and Switch – Case. **Basic Loop Structures**: Iterative Statements - for, while and do - while, Nested Loops, The

	'Break', 'Continue', and 'goto' statements.
UNIT III	**Arrays:** Declaration and Initialization of Arrays, Accessing & Storing the elements of an Array, Operations on Arrays: Traversing, Inserting, Deleting, Searching, Two Dimensional Arrays: Declaring, Initializing, Accessing, Operations on Two Dimensional Arrays (Matrices), Applications of Arrays. **Strings:** String Fundamentals, String Input and Output, String Library Functions
UNIT IV	**Functions:** Function Declaration / Function Prototypes, Function Definition, Function Call (Call by Value), Passing Parameters to Functions, Return Statement, Storage Classes, Recursive Functions, Arrays as Function Arguments. **Pointers**: Declaring Pointer Variables, Pointer Arithmetic, Passing Arguments to Function using Pointers (Call by Reference), Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation – Malloc, Calloc, Realloc, Free.
UNIT V	**Structures**: Introduction to Structures, Nested Structures, Array of Structures. **Unions:** Introduction, Array of Union Variables, Union inside Structure, Enumerated Data Types, Bit Fields. **Files**: Declaring, Opening, and Closing File, Reading from and Writing to Text Files.

TEXT BOOKS	
1.	Programming in C, Reema Thareja, 2nd Edition, Oxford University Press.
2.	The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education
REFERENCE BOOKS	
1.	Programming in C – Ashok N.Kamthane, Amit Ashok Kamthane, 3rd Edition, Pearson.
2.	C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage.
3.	Programming in C (A Practical Approach) – Ajay Mittal, First Edition, Pearson.
WEB RESOURCES	
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-computer-science/6-087-practical-programming-in-c-january-iap-2010/

Professional Communicative English Lab – I
(For ECE only)

Course Category	HUMANITIES	**Course Code**	19HE1L01
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 75

Course Outcomes

CO	Description	COGNITIVE LEVEL
CO1	Interpret and responding appropriately in various day to day contexts and will be able to use speech sounds effectively.	K2
CO2	Apply stress, intonation and pronunciation in conversations and learn formal communicative expressions.	K3
CO3	Attain the collection of dialogues and acclimate them to their real life situations with proper intonation.	K2

K1- Remembering, K2- Understanding, K3-Applying, K-4 Analyzing, K5- Evaluating, K6- Creating

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

PRESCRIBED LAB MANUAL FOR SEMESTER I:

'**STRENGTHEN YOUR STEPS**: A Multimodal Course in Communication Skills' Published by Maruthi Publications.

Objectives:
To enable the students to learn the communication skills; listening, speaking, reading and writing.
Outcome:
The course enables the learner to acquire communication skills which will help the students to become successful in the competitive world.
The course content along with the study material is divided into six units.
UNIT 1: Hello, I'm ……
Consonant Sounds
UNIT 2: I would love to …. But,
Vowel Sounds
UNIT 3: With your Permission, I would like to
Syllable and Accent
UNIT 4: Why don't we……
Pronunciation and Rhythm
UNIT 5: Could you please ……
Tones
UNIT-6: Dialogues

APPLIED PHYSICS LABORATORY

(I-I ECE, CSE & IT)

Course Category	BASIC SCIENCES	**Course Code**	**19BP1L02**
Course Type	Lab	**L-T-P-C**	0 -0 -3-1.5
Prerequisites	Intermediate Physics	**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 75

COURSE OBJECTIVES	
1	The student will have exposure to various experimental skills which is essential for an Engineering student.
2	To gain practical knowledge by applying the experimental methods to correlate with the Theoretical Physics.
3	Apply the Analytical techniques and graphical analysis to the experimental data

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Understand the basics of Interference, Diffraction in Physics using instruments like Spectrometer, Travelling microscope.	Understanding(K2)
CO2	Determine the Magnetic and Dielectric constants of materials.	Application(K3)
CO3	Apply the basics of Current Electricity and Semiconductors in engineering application	Application(K3)

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														
CO2	2														
CO3	2	2	2										1		

COURSE CONTENT: (Any 10 of the following listed 12 experiments)	
1.	Determination of wavelength of laser by diffraction grating.
2.	Determination of wavelength of a source-Diffraction Grating-Normal incidence.
3.	Newton's rings – Radius of Curvature of Plano - Convex Lens.
4.	Determination of thickness of a spacer using wedge film and parallel interference fringes.
5.	Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
6.	Energy Band gap of a Semiconductor p - n junction.
7.	Characteristics of Thermistor – Temperature Coefficients
8.	Determination of dielectric constant by charging and discharging method

9.	Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10.	Dispersive power of diffraction grating.
11.	To Study the V-I Characteristics and determine the breakdown voltage of a Zener Diode
12.	Determination of Hall Voltage and Hall coefficients of a given semiconductor using Hall effect.

TEXT BOOKS	
1.	Laboratory Manual of Engineering Physics by Dr.Y.Aparna&Dr.K.Venkateswara Rao (V.G.S Publishers)
REFERENCE BOOKS	
1.	College customized manual
WEB RESOURCES	
1.	https://www.youtube.com/watch?v=h_hUBXz-G-Y
2.	https://youtu.be/dgxFFw_1gMo
3.	https://www.youtube.com/watch?v=v2B0QyW8XJ0
4.	https://www.youtube.com/watch?v=AYQLmFqFtlw
5.	https://youtu.be/toggy3WVxV4
6.	https://youtu.be/1CyFsGk-_l4

Programming for Problem solving using C Laboratory

(Common to CE, ME, EEE, ECE, CSE, IT)

Course Category	Engineering Science	**Course Code**	19CS1L01
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 75

COURSE OBJECTIVES	
1	To learn various steps in program development using Raptor.
2	To write C programs using basic concepts in C like operators, control statements etc.,
3	To design modular, reusable and readable C programs using concepts like Arrays, Functions and Pointers.
4	To write programs using Structures and Unions.
5.	To write programs to perform file operations.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Translate given algorithms to a working programs.	L2
CO2	Design programs using Pointers to access Arrays, Strings and Functions.	L3
CO3	Develop programs using Structures, Unions and File operations.	L3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	0	0	0	0	0	0	0	2	2	1
CO2	3	3	3	3	2	0	0	0	0	0	0	0	2	2	1
CO3	3	3	3	3	2	0	0	0	0	0	0	0	2	2	1

COURSE CONTENT	
1.	Construct flowcharts using Raptor Tool to a) calculate the maximum, minimum and average of three numbers b) calculate area of a triangle given three sides using Heron's formula.
2.	Construct flowcharts using Raptor Tool to a) calculate simple interest for various parameters specified by the user. b) swapping of two numbers with and without using the third variable.
3.	Write a C Program to Perform Addition, Subtraction, Multiplication and Division of two numbers.
4.	Write a C Program to find the Grade of a student by taking input of percentage using all Relational Operators (>, >=, <, <=, ==, !=)

Theory (%)	**Letter Grade**	**Level**
≥ 90	O	Outstanding

≥ 80 to < 90	S	Excellent
≥ 70 to < 80	A	Very Good
≥ 60 to < 70	B	Good
≥ 50 to < 60	C	Fair
≥ 40 to < 50	D	Satisfactory
<40	F	Fail

5.	Write a C Program to swap two given input numbers a) With using a temporary variable. b) Without using a temporary variable.
6.	Write a C Program to implement arithmetic operations using two operands and one operator using a) if – else – if condition. b) Switch – Case statement.
7.	Write a C Program to print the following patterns a) Floyd's Triangle. b) Pascal Triangle.
8.	Write a C Program a) To find the sum of its individual digits for a given positive number. b) To check whether the given number is Prime or not.
9.	Write a C Program a) To check whether the given number is a Palindrome or not. b) To check whether the given number is an Armstrong or not
10.	Write a C Program using Functions to find both the largest and smallest number in an given array numbers.
11.	Write C programs to perform swapping of two numbers by passing a value and reference.
12.	Write a C Program for two Matrices by checking the compatibility a) Addition. b) Multiplication.
13.	Write a C program on Strings to implement the following operations without string handling functions a) Concatenation of two given input strings. b)Length of a string. c) Reverse of a given string.
14.	Write C programs that use both recursive and non-recursive functions for the following i) To find the factorial of a given integer. ii) To find the GCD (greatest common divisor) of two given integers. iii) To find Fibonacci sequence
15.	Write a C program using Pointers to work on a) Matrix Addition. b) Transpose of a Matrix.
16.	Write a C program to read and print the details of an Employee (Name, Date of the Birth, Designation, Salary) using Structures.
17.	Write a C program a) to read and print the student details (Name, Register number, Address, Intermediate %) using Union. b) to display the name of the colour using Enum data type
18.	Write a C Program to a) Copy one file to another. b)Count the number of characters, words and lines in a file.

Constitution of India

I B. Tech I Semester

Course Category	Humanities	**Course Code**	19HM1T05
Course Type	Theory	**L-T-P-C**	2-0-0-0
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	0 0 0

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 form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the evolution of Constitution of India	Understanding
CO2	Make use of their Fundamental rights.	Application
CO3	Understand the functioning of the Union Government	Understanding
CO4	Understand the functioning of the State and local self Government.	Understanding
CO5	Understand the value of Indian Constitution in functioning of the country.	Understanding

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	0	0	0	0	3	0	3	0	1	0	2
CO2	0	0	0	0	0	1	0	2	1	1	0	1
CO3	0	0	0	0	0	1	0	1	1	1	0	0
CO4	0	0	0	0	0	1	0	1	1	1	0	0
CO5	0	0	0	0	0	1	1	1	1	1	0	2

COURSE CONTENT	
UNIT I	Introduction to Indian constitution: Meaning of the term constitution - History and development – Preamble of the Constitution – Constituent Assembly – The salient features of Indian Constitution.
UNIT II	Fundamental Rights and Directive principles of state policy: Individual and Collective Rights – Limitations of the fundamental Rights – Judicial Interpretation of Fundamental Rights.
UNIT III	**Union Government:** Union Legislature – Lok sabha and Rajya sabha (powers and functions) – President of India (powers and functions) – Prime minister of India (powers and functions) – Union Judiciary (supreme court powers and functions).

UNIT IV	**State and Local self Government:** State Government:State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad) – Powers and functions of state legislature – The Chief Minister of the state (powers and functions) Local Self Government: Election commission of India (Powers and Functions)- The Union Public Service Commission (Powers and Functions)
UNIT V	**Working of the Indian Constitution** The values of the Indian Constitution and Ushering of Social Revolution in India – Nature and Role of Higher Judiciary in India – Amendments (Recent)

REFERENCE BOOKS	
1.	'Indian Polity' by Laxmikanth
2.	'Indian Administration' by Subhash Kashyap
3	'Indian Constitution' by D.D. Basu
4	'Indian Administration' by Avasti and Avasti
WEB RESOURCES	
1.	https://www.clearias.com/historical-background-of-indian-constitution/
2.	https://www.civilserviceindia.com/subject/General-Studies/notes/functions-and-responsibilities-of-the-union-and-the-states.html
3.	https://www.tutorialspoint.com/indian_polity/indian_polity_how_constitution_works

Numerical Methods and Multi-variable Calculus

(Common to CE, ME, ECE, CSE, &IT)

I B. Tech II Semester

Course Category	Basic Sciences	**Course Code**	19BM2T02
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Differentiation, Integration	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

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 form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	apply Newton, Gauss and Lagrange interpolation formulae to find interpolating polynomials for the given data.	K3
CO2	find the approximate roots of transcendental equations by using different numerical methods	K2
CO3	solve ordinary differential equations by using different numerical schemes	K3
CO4	Find areas and volumes using double and triple integrals	K2
CO5	apply a range of techniques to find solutions of standard PDEs	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**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's formulae for interpolation –Gauss formulae for interpolation- Interpolation with unequal intervals – Lagrange's interpolation formula.
UNIT II	**Solution of Algebraic and Transcendental Equations** Introduction- Bisection method – Method of false position – Secant method- Iteration method – Newton-Raphson method (One variable).
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 series-Picard's method of successive approximations-Euler's method - Runge-Kutta method (second and fourth order).
UNIT IV	**Multiple integrals** Multiple integrals: Double and triple integrals – Change of variables – Change of order of integration. **Applications:** Finding Areas and Volumes.

UNIT V	**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.

TEXT BOOKS	
1.	**B. S. Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**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, Subodh C. Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
6.	**T.Amarnath,** An Elementary Course in Partial Differential Equations, Narosa Publications
WEB RESOURCES	
1.	**UNIT I: Interpolation** https://en.wikibooks.org/wiki/Introduction_to_Numerical_Methods/Interpolation
2.	**UNIT II: Solution of Algebraic and Transcendental Equations** https://en.wikibooks.org/wiki/Numerical_Methods/Equation_Solving https://www.slideshare.net/100005232690054/algebraic-and-transcendental-equations
3.	**UNIT III: Numerical Integration and solution of Ordinary Differential Equations** https://nptel.ac.in/courses/111107063/
4.	**UNIT III: Multiple Integrals** https://en.wikipedia.org/wiki/Multiple_integral http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx
5.	UNIT V: **Partial Differential Equations** https://en.wikipedia.org/wiki/Partial_differential_equation

Integral Transforms and Vector Calculus

(Common to CE, EEE, ME, ECE, CSE & IT)

I B. Tech II Semester

Course Category	Basic Sciences	**Course Code**	19BM2T03
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

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 form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	examine the properties of Laplace transformation	K3
CO2	solve ordinary differential equations by using Laplace transformation technique	K2
CO3	expand a periodic function as a Fourier series and find Fourier transform of a given function.	K3
CO4	understand vector differential properties of scalar and vector point functions and their applications.	K2
CO5	apply Green's, Stokes and Divergence theorem to evaluate line, surface and volume integrals.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Laplace transforms:** Laplace transforms of standard functions – Properties - Periodic functions - Unit step function – Dirac's delta function.
UNIT II	**Inverse Laplace transforms:** Inverse Laplace transforms – Properties – Convolution theorem (without proof). **Applications:** Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT III	**Fourier Analysis:** Introduction- Periodic functions – Dirichlet's conditions - Fourier series of a function, even and odd functions –Change of interval – Half-range sine and cosine series. Fourier integral theorem (without proof) – Fourier sine and cosine integrals – sine and cosine transforms – Inverse transforms.
UNIT IV	**Vector Differentiation:** Gradient - Directional derivative - Divergence – Curl – Laplacian and second order operators – Vector identities.
UNIT V	**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.

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**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, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
6.	**Murray R Speigel,** Schaum's Outline of Vector Analysis, Schaum's Outline.
7.	**Shanti Narayan**, Integral Calculus – Vol. 1 & II
WEB RESOURCES	
1.	**UNIT I: Laplace transforms** https://en.wikipedia.org/wiki/Laplace_transform https://web.stanford.edu/~boyd/ee102/laplace.pdf
2.	**UNIT II: Inverse Laplace transforms** https://www.intmath.com/laplace-transformation/7-inverse-laplace-transform.php
3.	**Unit – III: Fourier Series** https://www.mathsisfun.com/calculus/fourier-series.html https://lpsa.swarthmore.edu/Fourier/Xforms/FXformIntro.html
4.	**UNIT IV: Vector Differentiation** https://en.wikipedia.org/wiki/Vector_calculus
5.	**UNIT V: Vector Integration** https://en.wikipedia.org/wiki/Divergence_theorem http://tutorial.math.lamar.edu/Classes/CalcIII/StokesTheorem.aspx

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APPLIED CHEMISTRY
(ECE)

Course Category	Basic Sciences	Course Code	19BC2T02
Course Type	Theory	L-T-P-C	3-0-3--4.5
Prerequisites	Intermediate Chemistry	Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
1	To learn about Electrochemical cells, Batteries and Fuel cells
2	To know about spinels, magnetic materials and semi conductors
3	To study about Nano materials, their preparation, characterization, applications and also about principles of green chemistry and green engineering applications
4	To know about Polymers, plastics and Elastomers
5	To learn about non conventional energy sources and also Spectroscopic techniques

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	To compare different types of batteries and explain the merits of fuel cell. (**L-1)**
CO2	Discuss the use and importance of semiconductors, magnetic materials and spinels.(**L-4**)
CO3	To explain the Green methods of Synthesis and applications of Green technologies **(L-3)**
CO4	Analyze the importance of polymers in engineering applications. **(L-4)**
CO5	List out various sources of non conventional energy**.(L-5)**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	2	2	2		2				2		1	
CO2	2	2	1			1	1				1			
CO3	1	1		1	2							1		
CO4	2	2		1			1					1		
CO5	**1**	1	1				1				2	1	1	

COURSE CONTENT	
UNIT I	**ELECTROCHEMICAL ENERGY SYSTEMS** **9hrs** Electrode Potential, Nernst Equation for a single electrode, EMF of the cell, Electro chemical Series and uses, Types of Electrodes - Hydrogen and Calomel electrode, Electrochemical Cell, Galvanic Cell vs Electrolytic Cell, Types of Ion Selective Electrodes- glass membrane electrode **Batteries**- Characteristics, classification and Important applications. Classical batteries- Dry/Lechlanche cell, Modern batteries- Zinc air, Lithium cells-Li MnO_2 cell. **Fuel cells**- Introduction, H_2-O_2 fuel cell. **Learning outcomes:** After the completion of the Unit I, the student will be able to • **Explain** the significance of electrode potentials.**(L-2)** • **Compare** different types of cells and batteries. **(L-2)** • **Classify** ion selective electrodes. (**L-2**) • **Explain** the concepts involved in the construction oflithium cells. **(L-2)** • **Apply** redox principles for construction of batteries and fuel cells. (**L-3)**
UNIT II	**SOLID STATE CHEMISTRY** Solids – Crystalline and amorphous solids- 2D and 3D close packing of atoms and ions - spinels - normal and inverse spinels, semi conductor – Elemental semi conducting materials - Non-elemental semiconducting Materials:- Stoichiometric, non stoichiometric controlled valency & Chalcogen semiconductors, Preparation of Semiconductors by Zone refining and Czocharlski crystal pulling

	method. Semiconducting Devices - p-njunction diode as rectifier and junction transistor. Electrical Insulators and Applications of solid, liquid and gaseous insulators. Magnetic materials- Ferro and ferri magnetism. Hall effect and its applications. **Learning Outcomes:** After the completion of the Unit II, the student will be able to • Explain 2D and 3D close packing of crystals (**L-3**) • identify different types of spinels. (**L-3**) • describe the mechanism of photo copying. (**L-2**) • explain the applications of electrical insulators. (**L-3**)
UNIT III	**NANOMATERIALS AND GREEN CHEMISTRY 7+5 hrs** **III-A: Nano Materials:** Introduction to Nano materials, Preparation of Carbon Nano Tubes(CNTs) by Laser Ablation and Chemical Vapor Deposition Methods, Fullerenes -Preparation, Properties and Applications; Chemical synthesis of nano materials : Sol-gel method, Characterization of nano mateirals by BET & TEM (basic principles), Applications of nano materials in waste water treatment, lubricants, Medicine and sensors. **III-B: Green Chemistry:** Introduction-Principles of green chemistry, Green synthesis Methods-Phase Transfer Catalysis (PTC), Super critical fluid extraction method, Green engineering applications in environmental and power quality monitoring. **Learning outcomes:** After the completion of the Unit III, the students will be able to • **explain** the basic principles of green chemistry. **(L-3)** • **identify** different preparation methods of CNTs**. (L-3)** • **discuss** the applications in green engineering. **(L-2)**
UNIT IV	**POLYMER CHEMISTRY 10hrs** **Polymers**: Introduction-Methods of Polymerization (Emulsion and Suspension), Conducting polymers – Mechanism of conduction in poly acetylene – applications, Bio – degradable polymers. **Plastics**: Thermoplastics and thermo setting resins; Preparation, properties and applications of Polystyrene and Bakelite. **Elastomers**: Natural Rubber, Vulcanization of rubber; Synthetic Rubbers -Preparation, properties and applications of Buna-S and Thiokol. **Learning Outcomes:** ***At the end of this unit, the students will be able to*** • **explain** different types of polymerisation mechanisms (**L-2**) • **distinguish** between thermoplastic and thermo setting resigns **(L-4)** • **explain** the preparation, properties and applications of Bakelite and polystyrene (**L-2**) • **describe** the mechanism of conduction in conducting polymers (**L-2**) • **discuss** Buna-S and Thiokol elastomers and their applications (**L-2**)
UNIT V	**Non Conventional Energy Sources & Spectroscopic Techniques 9 hrs** Non Conventional Energy Sources : Introduction-Photo voltaic cell & Organic Photo voltaic cell - Design, Principle, advantages and disadvantages; Hydropower-Geo thermal Power -Tidal Power-Ocean thermal Energy Conversion. Spectroscopic Techniques: Electro Magnetic Spectrum- Introduction, Principles of UV and IR Spectroscopic techniques and their applications. **Learning outcomes** After the completion of the Unit V, the student will be able to • **list** differentnon conventional energy sources. (**L-1)** • **explain**the basic principle involved in the working of power plants. (**L-2)** • **compare** Spectroscopic techniques and their importance. **(L-2)**

TEXT BOOKS	
1.	P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi (2014).
2	Engineering Chemistry by Shikha Agarwal: Cambridge University Press,2019 edition
REFERENCE BOOKS	
1.	Sashi Chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003)
2.	B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press (2013).
3.	S.S. Dara, A Textbook of Engineering Chemistry, S.Chand& Co, (2010)

WEB RESOURCES	
1.	Electrochemical Energy Systems https://en.wikipedia.org/wiki/Electrochemical_cell
2.	Solid state chemistry https://en.wikipedia.org/wiki/Solid-state_chemistry www.engineeringenotes.com › Engineering › Electronics › Semiconductors
3.	Nanomaterials and Green Chemistry https://en.wikipedia.org/wiki/Green_chemistry https://www.acs.org/.../greenchemistry/principles
4.	Polymer Chemistry https://en.wikipedia.org/wiki/Polymer_chemistry
5.	Non Conventional Energy Sources & Spectroscopic Techniques *https://en.wikipedia.org/wiki/Geothermal_power;*https://en.wikipedia.org/wiki/Ocean_thermal_energy_conversion www.rsc.org/learn-chemistry/collections/spectroscopy/introduction

NETWORK ANALYSIS

I B. Tech II Semester

Course Category	Basic Sciences	**Course Code**	**19EC2T01**
Course Type	Professional Core	**L-T-P-C**	3-0-0-3
Prerequisites	Basic knowledge in laplacezransforms,R,L,C properties.	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Basic knowledge about basic R,L,C elements , fundamentals of electrical circuits and network topology
2	Study the behavior of DC Circuits using transient analysis
3	Study the behavior of AC Circuits using steady state analysis
4	Simplification of circuits with various theorems and resonance

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	gain the knowledge on basic network elements.	K3
CO2	analyze the RLC circuits behavior in detailed	K2
CO3	analyze coupled circuits .	K3
CO4	minimize the given complicated network	K2
CO5	develop equivalent circuits using theorems	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	2	1	1	1	1						
CO2	**3**	3	2	1	1	1			1			1
CO3	**3**	2	2	1	1	1			1			
CO4	**3**	3	2	2	1	1			1			
CO5	**3**	2	2	1	1	1			1			

COURSE CONTENT	
UNIT I	**INTRODUCTION TO ELECTRICAL CIRCUITS** Network elements classification, Electric charge and current, Electric energyand potential, Resistance parameter – series and parallel combination, Inductance parameter – series and parallel combination, Capacitance parameter – series and parallel combination. Energy sources: Ideal, Non-ideal, Independent and dependent sources, Source transformation, star-delta conversion, 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 functions: Time period,Angular velocity and frequency, RMS value, Average value, Form factor and peak factor-problem solving. Duality of a network. **NETWORK TOPOLOGY** Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basic tie set schedule, basic cut set schedule only (problem solving not necessary) (Text Books: 2,3, Reference Books: 3)

UNIT II	**TRANSIENTS** First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DCexcitation, Evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots. Solutions using Laplace transform method. (Text Books: 1,2,3, Reference Books: 1,3)
UNIT III	**STEADY STATE ANALYSIS OF A.C CIRCUITS** Impedance concept, problem solving using mesh and nodal analysis. (Text Books: 1,2, Reference Books: 3) **COUPLED CIRCUITS** Coupled Circuits: Self inductance, Mutual inductance, Coefficient of coupling, analysis ofcoupled circuits, Natural current, Dot rule of coupled circuits, Conductively coupled equivalent circuits- problem solving.
UNIT IV	**RESONANCE** Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance.(Text Books:2,3, Reference Books: 3) **Network Theorems** Thevinin's, Norton's, Milliman's, Max Power Transfer problem solving using Impedences. Reciprocity, Compensation, Substitution, Superposition, Tellegens-problem solving using Resistors.(Text Books: 1,2,3, Reference Books: 2)
UNIT V	**TWO-PORT NETWORKS** Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h-parameters, Symmetric and Reciprocity conditions, 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)

TEXT BOOKS	
1.	Network Analysis – ME Van Valkenburg, Prentice Hall of India, 3rd Edition, 2000.
2.	Network Analysis and Filter Design by Chadha, Umesh Publications
3	Electric Circuit Analysis by Hayt and Kimmarle, TMH
REFERENCE BOOKS	
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 by K.Satya Prasad and S Sivanagaraju, Cengage Learning
WEB RESOURCES	
1.	https://nptel.ac.in/courses/108105053/pdf/L-10(GDR)(ET)%20((EE)NPTEL).pdf.
2.	http://www.engr.uky.edu/~donohue/ee211/ee211_11.pdf.
3.	https://www.sciencedirect.com/topics/engineering/coupled-circuits.

ELECTRONIC DEVICES AND CIRCUITS
(ECE)

I B. Tech I ISemester

Course Category	Professional Core	**Course Code**	**19EC2T02**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Semi Conductor Physics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

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

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the concepts various semiconductor devices.	K2
CO2	Design rectifiers and filter circuits for the given specifications.	K3
CO3	Understand the concepts of BJT and FET for various configurations	K2
CO4	Differentiate biasing, stabilization and compensation techniques of BJT circuits.	K2
CO5	Design amplifiers using BJT and FET.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1												
CO2	2		2		1									
CO3				1									2	
CO4		2	2		1						2			
CO5		1		2								2		

COURSE CONTENT	
UNIT I	**SEMICONDUCTOR DEVICES** **PN Junction Diode:** Introduction to Semiconductor Physics-Classification of Materials, Charge densities in semiconductors, Fermi Level in intrinsic and Extrinsic semiconductors. Open circuited PN junction, Biased PN junction, Diode Equation, Volt-Ampere Characteristics, Temperature dependence of V-I characteristics, Diode Resistance and Diode Capacitance. **Special Purpose Electronic Devices:** Breakdown Mechanisms in Semiconductor Diodes, Zener Diode Characteristics, Principle of Operation and Characteristics of Tunnel Diode (with the help of Energy Band Diagram), Varactor Diode, LED, Photo Diode.
UNIT II	**RECTIFIERS AND FILTERS** **Rectifiers:** 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, PIV, voltage regulation, Design of Zener as 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 III	**TRANSISTOR CHARACTERISTICS** **BJT:** Introduction, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, SCR, UJT. **FET:** Introduction, JFET types, construction, operation, characteristics, parameters, MOSFET - types, construction, operation, characteristics, comparison between JFET and MOSFET.
UNIT IV	**TRANSISTOR BIASING** Need for biasing, operating point, load line analysis, BJT biasing methods, bias stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in V_{BE}, I_C and β, Stability factors, (S, S', S''), Bias compensation Techniques, Thermal runaway, Thermal stability. FET Biasing methods and stabilization.
UNIT V	**SMALL SIGNAL ANALYSIS OF TRANSISTOR AMPLIFIER MODELS** **BJT:** Transistor hybrid model, determination 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.C.Halkias, and Satyabrata Jit, McGraw Hill Education. 4e, 2015
2.	Electronic Devices and Circuits – Mohammad Rashid, Cengage Learning, 2013.
3.	Semiconductor Physics and Devices-Donald A. Neamen, Third Edition , McGraw-Hill Higher-Education,
4.	Electronic Devices and Circuits – David A. Bell, 5 Ed, Oxford.
REFERENCE BOOKS	
1.	Electronic Devices and Circuits – BVRao, KBR Murty, K Raja Rajeswari, PCR Pantulu, Pearson, 2nd edition.
2.	Electronic Devices and Circuit Theory – RL Boylestad and LouisNashelsky, Pearson Publications, 10thEdition
3.	Electronic Devices and Circuits – B P Singh, RekhaSingh,PearsonPublications,Second Edition. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, 4th Edition, TataMc-Graw Hill.
WEB RESOURCES	
1.	www.satishkashayap.com/2013/03/video-lectures-on-electron-devices-by.html

ENGINEERING DRAWING
(Only for ECE)

Course Category	Engineering Science	**Course Code**	19ME2T01
Course Type	Theory	**L-T-P-C**	1-0-3-2.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To introduce the students to use drawing instruments and to draw polygons, Engineering Curves and Scales.
2	To introduce the students to use orthographic projections, projections of points and lines.
3	To make the students draw the projections of the planes.
4	To make the students draw the projections of the various types of solids.
5	To represent the object in 3D view through isometric views.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level***
CO1	Construct polygons, scales and engineering curves.	k3
CO2	Identify the position of points and lines with use of orthographic projections.	k3
CO3	Analyze the location and position of plane figures through orthographic projections.	k4
CO4	Analyze the location and position of solid bodies through orthographic projections.	k4
CO5	Develop 2D and 3D objects by converting their views.	k6

*k1- Remembering, k2- Understanding, k3- Applying, k4- Analyzing, k5- Evaluating, k6- Creating

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	1	-	-	-	-	-	1	-	-	-
CO2	3	2	1	2	1	-	-	-	-	-	1	-	-	-
CO3	3	2	1	2	1	-	-	-	-	-	1	-	1	1
CO4	3	2	1	2	1	-	-	-	-	-	1	-	2	2
CO5	3	2	1	3	3	-	-	-	-	-	1	-	2	2

COURSE CONTENT	
UNIT I	Introduction to Engineering Drawing. **Polygons:** Constructing regular polygons by general method. **Curves:** Parabola, Ellipse and Hyperbola by general methods tangent & normal for the curves. Cycloid and Involutes. **Scales:** Vernier and Diagonal scales.
UNIT II	**Orthographic Projections:** Introduction, importance of reference lines, projections of points in various quadrants. Projections of straight lines inclined to both the planes, determination of true lengths and angle of inclination.
UNIT III	**Projections of planes:** Regular planes perpendicular/parallel to one plane. Regular planes inclined to one plane and parallel to other, inclined to both the planes.
UNIT IV	**Projections of Solids:** Simple positions of Prisms, Pyramids, Cones and Cylinders. Solids inclined to both the planes.
UNIT V	**Isometric Projections:** Introduction, Conversion of isometric views to orthographic views, Conversion of orthographic views to isometric views. Introduction to AutoCAD (Demo only)

TEXT BOOKS	
1	Engineering Drawing by N.D. Bhatt, Chariot Publications, 56th Edition.
2	Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age International (P) Limited (2008).
REFERENCE BOOKS	
1	Engineering Drawing by K.L.Narayana& P. Kannaiah, Scitech Publishers, 3rd Edition.
2	Engineering Graphics for Degree by K.C. John, PHI Publishers.
3	Engineering Graphics by PI Varghese, Mc Graw Hill Publishers, 2013.
4	Engineering Drawing by Basant Agarwal, Tata McGraw Hill Publishers, 2014.
5	B.V.R. Gupta & M. Raja Roy, Engineering Drawing, I.K. International Publishing House Pvt. Ltd., 2009.
WEB RESOURCES	
1	http://nptel.ac.in/courses/1121019/
2	http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html
3	https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/env_health_science_students/engineeringdrawing.pdf

Applied Chemistry Laboratory

Course Category	Basic sciences	**Course Code**	**19BC2L02**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Basic Chemistry	**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 75

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Students will learn to estimate the given amount of dissolved compounds in water by using volumetric analysis and preparation of polymers and nano particles	Analyzing
CO2	Students will be able to learn compelxometric titrations to determine the concentration of different metal ions present in water and determine the % moisture in a coal sample.	Applying
CO3	Students will be able to identify the accurate value of conductivity of given solutions. and to estimate the viscosity and surface tension of given solutions.	Analyzing

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2											
CO2	2	1		1										
CO3	2	1												

LIST OF EXPERIMENTS:
Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis

Any 10 of the following experiments are to be conducted

Experiment 1	Estimation of HCI using standard Na_2CO_3 solutions
Experiment 2	Determination of alkalinity of a sample containing Na_2CO_3 and NaOH
Experiment 3	Estimation of $KMnO_4$ using standard Oxalic acid solution
Experiment 4	Estimation of Ferrous iron using standard $K_2Cr_2O_7$ solution
Experiment 5	Determination of Temporary and permanent Hardness water using standard EDTA solution.
Experiment 6	Determination of % moisture content in a coal sample.
Experiment 7	Determination of Mg^{2+} present in an antacid
Experiment 8	Conductometric Titrations between strong acid and strong base
Experiment 9	Conductometric Titrations between strong acid and weak base
Experiment 10	Estimation of Vitamin – C
Experiment 11	Preparation of Phenol - Formaldehyde Resin
Experiment 12	Determination of viscosity of a liquid
Experiment 13	Determination of surface tension of a liquid

Experiment 14	Preparation of Nano particles.(Cu/Zn)
TEXT BOOKS	
1	Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B Vogel's Quantitative Chemical Analysis 6/e, Pearson publishers (2000).
2	N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company (2007).
REFERENCES	
1	Vogel's Textbook of Quantitative chemical analysis, J. Mendham et.al.
2	College designed manual
WEB REFRENCES	
1	www.bsauniv.ac.in/UploadImages/Downloads/Estimation%20of%20Hardness
2	https://pubs.acs.org/doi/abs/10.1021/i560133a023
3	https://pdfs.semanticscholar.org/33d4/3b264bad212a14d660667298f12944ea11d5

References – Lab Manuals will be provided

PROFESSIONAL COMMUNICATIVE ENGLISH LAB- II
(For ECE only)

Course Category	Humanities	**Course Code**	19HE2L02
Course Type	Theory	**L-T-P-C**	0-0-2-1
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 75

Course Outcomes

CO	Description	COGNITIVE LEVEL
CO1	Develop the required communication skills to present effective presentations and interviews with clarity and impact.	K2
CO2	Able to create constructive and elaborative discussions to share their ideas on several issues.	K3
CO3	Ensure to use of argumentative and critical thinking skills by elaborating ideas relevantly and improve team work.	K3

K1- Remembering , K2- Understanding, K3-Applying, K-4 Analyzing, K5- Evaluating, K6- Creating

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

PRESCRIBED LAB MANUAL FOR SEMESTER II:

'**STRENGTHEN YOUR STEPS**: A Multimodal Course in Communication Skills', Published by Maruthi Publications.

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.

UNIT-1: Small Talk & JAM Session
UNIT-2: Interviews
UNIT-3: Effective Telephonic Interviews
UNIT-4: Group Discussions
UNIT-5: Presentations & Public Speaking
UNIT-6: Debates

ELECTRONIC WORKSHOP

(For B. Tech ECE)

Course Category	Lab Course	**Course Code**	**19EC2L01**
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	40 60 100

1. IDENTIFICATION of components
2. Laboratory equipment
3. Soldering practice
4. PCB Layout
5. Testing of components
6. CRO
7. Fiber optical kit

IDENTIFICATION of components:
Resistors: Type of resistors, value of resistance using color code
Capacitors: Type of Capacitors, value of capacitance using color code
Inductors: type of inductors, DLB
Rheostats: Types of rheostats, types of potentiometer, relays
Switches: type of switches
Cables: types of cables
Types of instruments used
Identification of active elements(Two terminal, three terminal devices)
SC diode, Zener diode, D.AC
three terminal devices: BJT,UJT,SCR,MOSFET,FET,TRIAC
Digital and Analog ICs(TO and Flat packages) IC regulators types
Testing of above components using multimeters
Laboratory Equipment
A) Meters Types of Voltmeters, Types of Ammeters both Analog and Digital. Types of Multimeters (Analog & Digital) AVO Meters. FET input Voltmeter.
B) Laboratory Function Generators and Audio Oscillators..
. C)Power Supplies
. D)RF generators
E)Different Types of Transformers (Power, AF, RF, etc..)

Soldering practice
Tools kit including soldering iron ToolsKit: Insulated nose player Insulated cutting player Screw driver kit Electrical tester Soldering iron, Lead, Flex
PCB layout and Design.
Materials required, centimeter graph sheets, marker.
Testing of Components.
Active and Passive Components
CRO
Acquaintance with CRO Measurements on CRO
Acquaintance of fiber optical kit-Transmitter & receiver
Acquaintance with various types of Transducers

Environmental Studies
(Common to All Branches)

Course Category	Basic Sciences	**Course Code**	**19BE2T01**
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 0
Prerequisites	Exposure Basic Knowledge in Environment and protection.	**InternalAssessment** **Semester EndExamination** **Total Marks**	0 0 0

COURSE OBJECTIVE:	
1	To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

COURSE OUTCOMES		**LEVEL**
Upon successful completion of the course, the student will be able to:		
CO1	Recognize the interconnectedness of human dependence on the earth's ecosystems	**K -II**
CO2	Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities	**K -I**
CO3	Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century	**K -II**
CO4	Gain a higher level of personal involvement and interest in understanding and solving environmental problems.	**K -II**
CO5	Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices	**K -III**
CO6	Influence their society in proper utilization of goods and services.	**K -I**

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	0	1	0	0	1	2	0	0	0	1	0	0	0
CO2	0	1	0	0	0	0	1	0	0	0	0	0	0	0
CO3	0	0	0	0	2	0	1	0	0	0	0	0	0	0
CO4	0	0	0	0	1	1	3	0	0	0	0	0	0	0
CO5	0	0	0	0	0	0	3	1	0	0	0	0	0	0

Course contents:

UNIT – I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance-Need for public awareness.

Natural Resources:

Forest resources : deforestation – Mining, dams and other effects on forest and tribal people.
Water resources :Use and over utilization of surface and groundwater.
Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems.
Energy resources: renewable and nonrenewable energy sources.
Role of an individual in conservation of natural resources.Equitable use of resources for sustainable lifestyles.

LEARNING OUTCOMES:

Students will be able to

1. Articulate the basic structure, functions, and processes of key social systems affectingthe environment
2. Explain why renewable and non-renewable energy resources are important..
3. Explain how water resources should be used.

UNIT-II ;Ecosystems, Biodiversity and its conservation: Definition of Ecosystem and its structure, Functions

Biodiversity Definition-Value of biodiversity, India as a mega-diversity nation, Threats to biodiversity, Conservation of biodiversity

LEARNING OUTCOMES:

Students will be able to

1. Get a clear picture of structure and functions of ecosystems.
2. Demonstrate knowledge and understanding of theories in the field of Biodiversity and Systematic in the broad sense.

UNIT-III: Environmental Pollution: Definition, Cause, Effects of Air pollution, Water pollution, Noise pollution, Radioactive pollution, Role of an individual in prevention of pollution.

Solid Waste Management: Sources, effects and control measures of urban and industrial waste.

LEARNING OUTCOMES Students will be able to

1. Understand Cause, effects and control measures of air pollution.
2. Explain the enforcement of Environmental legislation
3. Understand solid waste management.

UNIT-IV:Social Issues and the Environment: Air (Prevention and Control of Pollution) Act 1981. –Water (Prevention and control of Pollution) Act 1974,EPA act 1986 ,Issues involved in enforcement of environmental legislation**,** Rain water harvesting, Global Environmental challenges climate change and mitigations and Adaptations (Engineering technologies)

LEARNING OUTCOMES:

Students will be able to

1. Explain the enforcement of Environmental legislations
2. Acquire knowledge on various environmental challenges induced due to unplanned anthropogenic activities.

UNIT-V: Human population and the Environment:

Population growth,Women and child welfare, Role of Information technology in environment and human health Awareness to Environmental Assessment& clearance ,Audit .Environmental Governance in india E-Waste management Rules (Biomedical Waste, Solid Waste) **Field work:A** mini project related to Environmental issues / To visit a local polluted site (Submission of project by every student)

LEARNING OUTCOMES Students will have

1. Explain various types of information technologies
2. Explain the theories of population explosion

TEXT BOOKS	
1.	Environmental Studies for undergraduate courses by ErachBharucha,UGC.
2.	A Textbook of Environmental Studies by Dr.S.AzeemUnnisa,Acadamic publishing company.
3.	Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai
4.	A Textbook EIA Notification 2006(2019)
REFERENCE BOOKS	
1.	Text Book of Environmental Studies by Deeshita Dave & P. UdayaBhaskar, Cengage learning.
2.	Glimpses of Environment by K.V.S.G. Murali Krishna Published by Environmental Protection Society, Kakinada, A.P.
3.	Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi
WEB RESOURCES	
1.	**UNIT-1: MULTI DISPLINARY NATURE OF ENVIRONMENT and NATURAL RESOURCES** http://www.defra.gov.uk/environment/climatechange
2.	**UNIT-2:ECOSYSTEM, BIODIVERSITY AND ITS CONSERVATION** http://conbio.net/vl/ and www.biodiversitya-z.org/content/biodiversity
3.	**UNIT-3: ENVIRONMENTAL POLLUTION** https://www.omicsonline.org/environment-pollution-climate-change.php and
4.	**UNIT-4: Social Issues and the Environment** http://www.publichealthnotes.com/solid-waste-management/
5.	**UNIT-5: HUMANPOPULATION AND THE NVIRONMENT** **http://IPCC.com**

SWITCHING THEORY AND LOGIC DESIGN
(ECE)

II B. Tech I Semester

Course Category	Professional Core	**Course Code**	**19EC3T04**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

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, Boolean function simplification using Karnaugh maps and Quine-McCluskey methods
3	To understand concepts of combinational circuits
4	To understand concepts of basic sequential circuits
5	To develop advanced sequential circuits

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	To solve a typical number base conversion, analyze new error coding techniques and behavior of logic gates.	K2
CO2	To Simplify Boolean functions using Karnaugh maps and Quine-McCluskey methods.	K2
CO3	To understand concepts of combinational circuits.	K3
CO4	To understand sequential circuits by learning flip-flops and their applications.	K3
CO5	To develop advanced sequential circuits with meelay and moore models	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2							1			1	
CO2	2	2	2							1			2	
CO3	1	2	3							1				2
CO4	2	1	3							1			1	
CO5	**2**	2	3							1				1

COURSE CONTENT	
UNIT I	Representation of numbers of different radix, conversation from one radix to another radix, r-1's compliments and r's compliments of signed members, problem solving. 4 bit codes, BCD, Excess-3, 2421, 84-2-1 9's compliment code etc., Logic operations and error detection & correction codes; Basic logic operations -NOT, OR, AND, Universal building blocks, EX-OR, EX-NOR - Gates, Standard SOP and POS, Forms, Gray code, error detection, error correction codes (parity checking, even parity, odd parity, Hamming code) NAND-NAND and NOR-NOR realizations.
UNIT II	**MINIMIZATION TECHNIQUES** Boolean theorems, principle of complementation & duality, De-morgan theorems, minimization of logic functions using Boolean theorems, minimization of switching functions using K-Map up to 6 variables, tabular minimization, problem solving (code-converters using K-Map etc..).
UNIT III	**COMBINATIONAL LOGIC CIRCUITS DESIGN** Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders, 4-bit binary subtractor, adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit, look-a-head adder circuit. Design of decoder, de-multiplexer, 7 segment decoder, higher order de-multiplexing, encoder, multiplexer, higher order multiplexing, realization of Boolean functions using decoders and multiplexers, priority encoder, 4-bit digital comparator.
UNIT IV	**SEQUENTIAL CIRCUITS I** Classification of sequential circuits (synchronous and asynchronous); basic flip-flops, truth tables and excitation tables (nand RS latch, nor RS latch, RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals). Conversion from one flip-flop to flip-flop. Design of ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.
UNIT V	**SEQUENTIAL CIRCUITS II** Finite state machine; Analysis of clocked sequential circuits, state diagrams, state tables, reduction of state tables and state assignment, design procedures. Realization of circuits using various flip-flops. Meelay to Moore conversion and vice-versa.

TEXT BOOKS	
1.	Switching and finite Automata theory - Zvikohavi, third edition, Cambridge university press
2.	Switching Theory and Logic Design by A. Anand Kumar, PHI, 3rd Edition
3.	Digital Logic and Computer Design by M Morris Mano, PHI.
REFERENCE BOOKS	
1.	Switching Theory and Logic Design by Hill and Peterson Mc-Graw Hill TMH second edition
2.	Modern Digital Electronics by RP Jain, TMH, 4th Edition.
3.	Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers, 5th Edition
	Digital electronics logic and design-Cherry Bhargava, BS Publications, 2019.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/117106086/
2.	https://www.urbanpro.com/online-class/switching-theory-and-logic-design/2604561

3.	https://www.coursera.org/learn/digital-systems

CONTROL SYSTEMS
(ECE)
II B. Tech I Semester

Course Category	Professional Core	**Course Code**	**19EC3T07**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	network analysis	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The student will learn the fundamental concepts of Control systems and mathematical modeling of the system difference between open loop control system and closed loop control system
2	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
3	Study the time domain specifications and frequency domain specifications Understand the difference between transient response and steady state response
4	understand the stability of control systems from the s domain analysis
5	understand the concept of state variable analysis

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Represent the mathematical model of a system and transfer function of mechanical & electrical systems.	K1
CO2	Determine the response of different servo motors and reduction techniques.	K2
CO3	Analyze the stability of different systems.	K3
CO4	Determine the frequency response of different order systems.	K2
CO5	Know the controllability and observability of control systems using state space techniques	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1							2	3	2
CO2	3	2	3	2	1							1	3	2
CO3	3	3	3	3	1							3	3	3
CO4	3	3	3	3	1							3	3	3
CO5	3	3	3	3	1							3	3	3

COURSE CONTENT	
UNIT I	**INTRODUCTION** System Control System, Open Loop Control System, Closed loop Control System, Different Examples **MATHEMATICAL MODELS OF PHYSICAL SYSTEMS** Differential equations of physical systems, Transfer functions, Block diagram Algebra, Signal flow graphs with illustrative examples Effects of Feedback**,** Feedback Characteristics and its advantages, Linearizing effect of feedback – Problem solving
UNIT II	**TRANSFER FUNCTION REPRESENTATION** Transfer Functions of DC and AC Servo motors, Block diagram representation by Signal flow graph, Block diagram reduction using Mason's gain formula -Problem solving **TIME RESPONSE ANALYSIS** Standard test Signals, Time response of first and second order systems, steady state errors and error constants, Design specifications of second order systems, Performance indices- Problem solving
UNIT III	**CONCEPTS OF STABILITY AND ALGEBRAIC CRITERIA** The concept of Stability, Necessary Conditions for Stability, Routh-Hurwitz Srability Criterion, Relative stability analysis- Problem solving **THE ROOT LOCUS TECHNIQUE-**Introduction, The Root Locus concepts, Construction of Root Loci - Problem solving
UNIT IV	**FREQUENCY RESPONSE ANALYSIS** Introduction, Correlation between time and frequency response, Polar Plots, Bode Plots, Nyquist Stability criterion - Problem solving.
UNIT V	**STATE VARIABLE ANALYSIS** Introduction, Concepts of State, State Variables and State models, State models for linear continuous-time systems, State variables and linear discrete-time systems, Solution of state equations and Concepts of Controllability and Observability - Problem solving.

TEXT BOOKS	
1.	**"Automatic Control Systems**" - Benjamin C. Kuo, FraridGolnaraghi, Wiley Student Edition, 8th Edition, 2003.
2.	**Control System Engineering"**- J.Nagarath and M.Gopal, New Age International Publishers, 5th Edition, 2009.
3.	**Modern Control Engineering**"- Katsuhiko Ogata, Pearson, 3th Edition, 1998
REFERENCE BOOKS	
1.	"**Control Systems"**– A NagoorKani, 2nd edition, RBA Publications.
2.	" **Control Systems Engineering**" - S. Salivahanan, R. Rengaraj, and G. R. Venkata Krishnan, Pearson, First Impression,2015
WEB RESOURCES	
1.	**nptel.ac.in/course/108101037/#**
2.	**http://ocw.mit.edu/resources/res-6-010**
3.	**www.learnersto.com/free-engineering-video-lectures-1to3**

SIGNALS & SYSTEMS
(ECE)

II B. Tech I Semester

Course Category	Professional Core	**Course Code**	**19EC3T08**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Linear Algebra & Fourier Analysis	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Representation and classification of signals and systems, Representation of signals using Fourier series
2	Representation of signals using Fourier transform, properties of Fourier transform and sampling theorem for band limited signals.
3	Time - Domain and Frequency Domain aspects of signals and systems
4	Representation of signals in S-Domain using Laplace transform and ROC
5	Z-Transform of sequences, properties of Z-Transform, realization of systems

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Characterize the signals and systems and analyze the continuous-time signals and continuous-time systems using Fourier series	K1
CO2	To analyze Fourier transform and its applications. apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruction.	K2
CO3	Understand the concepts of different types of systems and convolution, correlation operations	K2
CO4	To apply the concepts of Laplace transform for different types of signals along with ROC	K3
CO5	Apply z-transform to analyze discrete-time signals and systems.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											3	1
CO2	3	2											3	1
CO3	3	2											3	1
CO4	3	2											3	1
CO5	3	2											3	1

COURSE CONTENT	
UNIT I	**INTRODUCTION AND FOURIER SERIES** Definition of Signal and System, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function. Representation of discrete time signals. Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum.
UNIT II	**FOURIER TRANSFORM AND SAMPLING THEOREM** Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Graphical and analytical proof for Band Limited Signals, impulsesampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling.
UNIT III	**ANALYSIS OF LINEAR SYSTEMS** Linear system, impulse response, Response of a linearsystem, Linear time invariant (LTI) system, Linear time variant (LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, 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. 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.
UNIT IV	**LAPLACE TRANSFORM** Review of Laplace transforms, Partial fraction expansion, InverseLaplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Relation between L.T's, and F.T. of a signal.
UNIT V	**Z–TRANSFORM** Fundamental difference between continuous-time and discrete-time signals,discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal, Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms.

TEXT BOOKS	
1.	Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn 2018.
2.	Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
3.	Signals and Systems – T K Rawat , Oxford University press, 2011
4.	Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition.
REFERENCE BOOKS	
1.	Signals and Systems – A.Anand Kumar PHI, 2nd Edn 2012
2.	Signals and Systems – Signals and Systems – M.J. Roberts,3rd Edition,MC Graw-Hill,2019
3.	Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.
4.	Signals & Systems- Narayan Iyer and K Satya Prasad, Cenage Pub 2011
WEB RESOURCES	
1.	https://nptel.ac.in/downloads/117101055/
2.	http://fourier.eng.hmc.edu/e102/lectures/FourierTransforms/
3.	http://fourier.eng.hmc.edu/e102/lectures/sampling/

INTERNET OF THINGS

(ECE)

II B. Tech I Semester

Course Category	Professional Core	**Course Code**	**19EC3T10**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To assess the vision and introduction of IoT.
2	To Understand IoT Market perspective.
3	To Implement Data and Knowledge Management and use of Devices in IoT Technology
4	To Understand State of the Art - IoT Architecture
5	To classify Real World IoT Design Constraints, Industrial Automation in IoT.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the concepts of Internet of Things	K2
CO2	Understand Challenges in IoT	K2
CO3	Understand the concept of M2M(machine to machine) with necessary protocols	K2
CO4	Analyze the domain specific applications of IoT	K3
CO5	Develop real life IoT based projects	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1							1		2	2
CO2	3	2	2	2							1		3	2
CO3	3	3	2	1							1		3	2
CO4	2	2	1	2							1		2	2
CO5	3	3	2	2							1		3	1

COURSE CONTENT	
UNIT I	**INTRODUCTION TO IOT** Definition of IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs.
UNIT II	**CHALLENGES IN IOT** Design challenges, Development challenges, Security challenges, Technological challenges, Business challenges, Societal problems
UNIT III	**IOT & M2M** Machine to Machine, Difference between IoT and M2M, Software define Network **Hardware Components**- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP
UNIT IV	**DOMAIN SPECIFIC APPLICATIONS OF IOT** Home automation, Environment, Industry applications, Surveillance applications, Other IoT applications
UNIT V	**DEVELOPING IOTS** Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python.

TEXT BOOKS	
1.	Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1 stEdition, VPT, 2014. (ISBN: 978-8173719547)
2.	WaltenegusDargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
REFERENCE BOOKS	
1.	Srinivasa K.G., Siddesh G.M.,Hanumantha Raju R. “Internet of Things” Cengage Publications, 1st Edition 2018
2.	Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224
WEB RESOURCES	
1.	https://link.springer.com/chapter/10.1007/978-3-319-04223-7_3
2.	https://www.businessinsider.com/internet-of-things-devices-applications-examples-2016-8?IR=T

Managerial Economics and Financial Analysis (Common to all branches)

CourseCategory	Humanities including Management	**Course Code**	19HM3T01
CourseType	Theory	**Lecture-Tutorial-Practice**	3 -0 -0
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

Course Outcomes		**Blooms Taxonomy Level**
On successful completion of the course, the student will be able to		
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	Understanding
CO4	Appraise the forms of business organizations and trade cycles in economic growth.	Evaluating
CO5	Apply accounting and capital budgeting techniques in financial decision making	Applying

Contribution of Course Outcomes towards achievement of Program												
Outcomes: 1 – Low, 2 - Medium, 3 – High												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	0	2	0	0	0	0	0	0	0	0	0	0
CO2	0	1	0	0	0	0	0	0	0	0	3	0
CO3	0	1	0	0	0	0	0	0	0	0	0	0
CO4	0	0	0	0	0	0	0	0	0	0	0	1
CO5	0	3	0	0	0	0	0	0	0	0	1	0

Course Content :

Unit – I

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Basic Economic Tools used in Managerial Economics-Concepts of Demand-Types-Determinants-Law of Demand its Exceptions-Elasticity of Demand-Types and Measurement- Law of Supply -Demand forecasting and Methods of demand forecasting.

Unit – II

Production and Cost Analysis: Production function- Law of Variable proportions- Iso-quants and Isocosts- Laws of Returns to Scale-Cobb-Douglas Production function-Economies of Scale-Cost Concepts- Fixed vs Variable Costs-Out of Pocket Costs vs Imputed Costs-Cost Volume Profit

analysis-Determination of Break-Even Point (Simple Problems).

Unit – III

Introduction to Markets: Market Structures: Perfect Competition, Monopoly, Monopolistic and Oligopoly – Features – Price and Output Determination.

Theories of the Firm & Pricing Policies: Managerial Theories of firm: Marris and Williamson's models – Methods of Pricing: Limit Pricing, Market Skimming Pricing, Internet Pricing: Flat Rate Pricing, Usage sensitive, Transaction based pricing, Priority Pricing.

Unit – IV

Types of Business Organization and Business Cycles: Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycles.

Unit – V

Introduction to Accounting and Capital Budgeting: Introduction to Double Entry Systems-Journal-Ledger- Trail Balance - Preparation of Financial Statements

Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.

Textbooks:

1. Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.
2. Dr. N. Appa Rao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011
3.. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011

Reference Books :

1. V. Maheswari: Managerial Economics, Sultan Chand.
2. Suma Damodaran: Managerial Economics, Oxford 2011.
3. Prof. J.V.PrabhakaraRao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.
4. Vanitha Agarwal: Managerial Economics, Pearson Publications 2011.
5. Sanjay Dhameja: Financial Accounting for Managers, Pearson.
6. Maheswari: Financial Accounting, Vikas Publications. 7. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012

Web Resources:

1. https://economictimes.indiatimes.com/definition/law-of-supply
2. https://sites.google.com/site/economicsbasics/managerial-theories-of-the-firm
3. https://www.managementstudyguide.com/capitalization.htm

BASIC ELECTRICAL ENGINEERING LABORATORY

(For B. Tech ECE)

Course Category	Lab Course	**Course Code**	**19EE3L01**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Basic Electrical Engineering	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To determine the performance of DC Machine and Transformer.
2	To control the speed of the DC Motor.
3	To analyze performance of three phase induction motor and determine the regulation of alternator by synchronous impedance method.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Determine the performance of DC Machines and Transformers.	Analyzing
CO2	Control the speed of DC motor.	Applying
CO3	Perform tests on 3-phase induction motor and alternator to determine their performance characteristics.	Analyzing

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	0	1	0	0	2	0	0	1	0	0
CO2	3	2	2	1	0	1	0	0	2	0	0	1	0	0
CO3	3	2	2	1	0	1	0	0	2	0	0	1	0	0

LIST OF EXPERIMENTS:	
Any 10 of the following experiments are to be conducted	
Experiment 1	Magnetization characteristics of DC shunt generator.
Experiment 2	Speed control of DC Shunt motor by Field and Armature control
Experiment 3	Brake test on DC shunt motor.
Experiment 4	Swinburne's test: predetermination of efficiencies as DC generator and dc motor
Experiment 5	Load test on DC Shunt generator.
Experiment 6	Load test on DC series generator.
Experiment 7	OC & SC test on single phase transformer.
Experiment 8	Brake test on 3-phase induction motor.
Experiment 9	Regulation of 3-phase alternator by synchronous impedance method.
Experiment 10	Separation of losses in DC shunt motor.
Experiment 11	Separation of core losses of a single phase transformer.
Experiment 12	Direct load test on Single phase transformer.

References – Lab Manuals will be provided

ELECTRONIC DEVICES AND CIRCUITS LABORATORY

(ECE)

II B.Tech I Semester

Course Category	Lab Course	**Course Code**	**19EC3L02**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	EDC	**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 75

COURSE OBJECTIVES	
1	To plot the V-I characteristics of semi conductor diodes, transistors.
2	To calculate ripple factor and efficiency of rectifiers
3	To plot the frequency response of different amplifiers and design of oscillator circuits

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basic knowledge and analyze the characteristics of pn DIODE,TRANSISTOR,FET,UJT,SCR.	K2
CO2	Calculate the ripple factor for half wave and full wave rectifiers with and without filters	K2
CO3	Analyze CE and CC amplifiers.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2					1		2	1			1	1
CO2	1	1							2	1			1	1
CO3	1	1					1		2	1			1	1

LIST OF EXPERIMENTS:

PART A: identification of Components

1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO

PART B: Any 10 of the following experiments are to be conducted

Experiment 1	P-N Junction Diode Characteristics Part A: Forward bias) Part B: Reverse bias
Experiment 2	Zener Diode Characteristics

	Part A: V-I Characteristics Part B: Zener Diode as Voltage Regulator
Experiment 3	BJT Characteristics(CE Configuration) Part A: Input Characteristics Part B: Output Characteristics
Experiment 4	FET Characteristics(CS Configuration) Part A: Drain Characteristics Part B: Transfer Characteristics
Experiment 5	SCR Characteristics
Experiment 6	UJT Characteristics
Experiment 7	Rectifiers Part A: Half-wave Rectifier Part B: Full-wave Rectifier
Experiment 8	Rectifiers With C-Filter Part A: Half-wave Rectifier Part B: Full-wave Rectifier
Experiment 9	CRO Applications (Amplitude, Frequency, Phase shift, L-Figures, Gear Wheel Patterns)
Experiment 10	Ri, Ro, Av of CE Amplifier
Experiment 11	Ri, Ro, Av of CC Amplifier
Experiment 12	Ro, Av of CS Amplifie

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

References – Lab Manuals will be provided

SWITCHING THEORY AND LOGIC DESIGN LAB

(ECE)

II B.Tech I Semester

Course Category	Lab Course	**Course Code**	**19EC3L03**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	EDC	**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 75

COURSE OBJECTIVES	
1	To verify the truth table of logic gates
2	To verify the function of combinational of logic circuits using truth tables
3	To verify the function of sequantial of logic circuits using truth tables

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	To understand the concepts of Logic gates	K2
CO2	To understand concepts of combinational circuits.	K2
CO3	To understand sequential circuits by learning flip-flops and their applications.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2					1		2	1			1	1
CO2	1	1							2	1			1	1
CO3	1	1					1		2	1			1	1

LIST OF EXPERIMENTS:	
Any 10 of the following experiments are to be conducted	
Experiment 1	Verification of truth tables of Logic gates Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive OR (vi) Exclusive NOR
Experiment 2	Design a simple combinational circuit with three variables with minimal SOP expression and verification of truth table
Experiment 3	Verification of functional table of 3 to 8 line Decoder / Demultiplexer
Experiment 4	4 variable logic function verification using 8 to 1 multiplexer.
Experiment 5	Design full adder circuit and verify its functional table.
Experiment 6	Verification of functional tables of (i) J K Edge triggered Flip – Flop (ii) J K Master Slave Flip – Flop (iii)D Flip – Flop
Experiment 7	Design a four bit ring counter using D Flip – Flops / JK Flip Flop and verify the output
Experiment 8	Design a four bit Johnson's counter using D Flip-Flops / JK Flip Flops and verify

	output
Experiment 9	(a) Design Four bit buffer register using D Flip – Flops / JK Flip-Flops and verify output. (b) Design four bit shift right register using D Flip-Flops / JK Flip-Flops and verify output.
Experiment 10	Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test it with a low frequency clock.
Experiment 11	Design MOD – 8 synchronous counter using T Flip-Flop and verify the result
Experiment 12	(a) Draw the circuit diagram of a single bit comparator and test the output (b) Testing of 7 segment Display with common cathode.

References – Lab Manuals will be provided

Essence of Indian Traditional Knowledge (Common to all branches)

Course Category	Humanities including Management	**COURSE CODE**	19HM3T06
Course Type	Theory	**Lecture-Tutorial-Practice**	2 -0 -0
Prerequisites		Total Marks (Internal Assessment)	100

Course Outcomes		**Blooms Taxonomy Level**
On successful completion of the course, the student will be able to		
CO 1	Understand the significance of Indian Traditional Knowledge.	Understanding
CO 2	Classify the Indian Traditional Knowledge	Analysis
CO 3	Compare Modern Science with Indian Traditional Knowledge system.	Evaluating
CO 4	Analyze the role of Government in protecting the Traditional Knowledge	Analysis
CO 5	Understand the impact of Philosophical tradition on Indian Knowledge System.	Understanding

Contribution of Course Outcomes towards achievement of Program												
Outcomes: 1 – Low, 2 - Medium, 3 – High												
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO11**	**PO 1**
CO1	0	1	2	0	0	3	0	1	0	2	0	0
CO2	0	0	2	0	0	2	0	2	0	0	0	0
CO3	0	0	2	0	0	3	0	1	1	2	2	1
CO4	0	0	2	0	0	2	0	2	0	0	0	0
CO5	0	0	1	0	0	3	0	1	0	3	0	1

Course Content :

Unit I

Introduction to Traditional Knowledge: Define Traditional Knowledge- Nature and Characteristics- Scope and Importance- kinds of Traditional Knowledge- The historical impact of social change on Traditional Knowledge Systems- Value of Traditional knowledge in global economy.

Unit II

Basic structure of Indian Knowledge System: Astadash Vidya- 4 Ved - 4 Upaved (Ayurved,Dhanurved,GandharvaVed&SthapthyaAdi),6vedanga(Shisha,Kalppa,Nirukha,Vykaran,Jyothisha &Chand),4upanga(Dharmashastra,Meemamsa,purana&Tharka Shastra).

Unit III

Modern Science and Indian Knowledge System-Indigenous Knowledge, Characteristics- Yoga and Holistic Health care-cases studies.

Unit IV

Protection of Traditional Knowledge: The need for protecting traditional knowledge -Significance of Traditional knowledge Protection-Role of government to harness Traditional Knowledge.

Unit V

Impact of Traditions: Philosophical Tradition (Sarvadarshan) Nyaya, Vyshepec, Sankhya, Yog, Meemamsa, Vedantha, Chavanka, Jain &Boudh - Indian Artistic Tradition - Chitra kala, Moorthi kala, Vasthu kala , Sthapthya, Sangeetha, NruthyaYevamSahithya

Reference Books :

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya
4. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6. Pramod Chandra, India Arts, Howard Univ. Press, 1983.
7. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.

Web Resources:

1. https://www.wipo.int/wipo_magazine/en/2017/01/article_0004.html

2. http://iks.iitgn.ac.in/wp-content/uploads/2016/01/Indian-Knowledge-Systems-Kapil-Kapoor.pdf

3.https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_text.pdf

ELECTRONIC CIRCUIT ANALYSIS

(ECE)

II B. Tech II Semester

Course Category	Professional Core	**Course Code**	**19EC4T11**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	EDC	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Analyze a single stage amplifiers at high frequencies using transistors and FETs
2	Analyze multistage amplifiers using transistors and FET
3	Design feedback amplifiers, oscillators for different applications
4	Design power amplifier for different applications
5	Apply tuned amplifiers for communication systems

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze BJT and FET single stage amplifiers at high frequencies.	K3
CO2	Analyze BJT and FET multistage amplifiers.	K3
CO3	Design feedback amplifiers for different applications**.**	K3
CO4	Analyze power amplifiers.	K3
CO5	Demonstrate the applications of tuned amplifiers.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	--										3	3
CO2	3	3	3								1		3	3
CO3	3	3	3		2					3	2		3	3
CO4	3	3	3								2		3	3
CO5	3	2	2	3	2					3	2		3	3

COURSE CONTENT	
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 AMPLIFIERS** Classification of amplifiers, methods of coupling, cascaded transistor amplifier and its analysis**,** two stage RC coupled amplifier analysis using BJT and FET, High input Resistance Transistor, amplifier circuit and their analysis, Darlington pair amplifier, cascode amplifier, Differential amplifier using BJT.
UNIT III	**FEEDBACK AMPLIFIERS** Feedback Principle and concept, 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. **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, Frequency and amplitude stability of oscillators.
UNIT IV	**POWER AMPLIFIERS** Classification of amplifiers, Class A power amplifiers and their analysis, Harmonic Distortions, Class B push pull amplifiers and their analysis, complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifiers, heat sink, advanced power amplifiers, distortion in amplifiers.
UNIT V	**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, wideband amplifiers.

TEXT BOOKS	
1.	Integrated Electronics – J Millman and C CHalkias, TMH, 1972.
2.	Electronic Devices and Circuit Theory – Robert L Boylestad and Louis Nashelsky, 10th edition, Pearson Publications.
3.	Microelectronic Circuits – Sedra A S and K C Smith, 6th edition, Oxford University Press.
REFERENCE BOOKS	
1.	Electronic Circuit Analysis and Design – Donald A Neaman, TMH.
2.	Electronic Circuits-I – Ravish R Singh, 1st Edition 2012, Pearson Publications
3.	Electronic Circuit Principles and Application – R D S Samuel, B Sujatha, Elesevier Publications.
4.	Electronic Circuit Analysis – Salivahanan, N Suresh Kumar, A Vallavaraj, 1st Edition, TMH, 2012.
WEB RESOURCES	
	nptel.ac.in/courses/117101106 http://www.jntubook.com/electronics-circuit-analysis-textnbook-free-download/ www.freebookcentre.net/electronic-circuit-analysis

RANDOM VARIABLES AND STOCHASTIC PROCESSES

II B. Tech II Semester

Course Category	Professional Core	**Course Code**	**19EC4T12**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Signals and Systems	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The basic concepts of probability, theorems along with mathematical solution, type of operations that can be performed with random variables
2	Two random variables, characterization of joint density and distribution functions
3	Introduction of time axis to the Random Variable
4	Frequency domain representation of RV
5	Responses are studied in terms of convolution, mean, squared values and linear systems

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the concept of a Random variable and its classification	K2
CO2	Understand the significance of Moments of a random variable	K2
CO3	Differentiate between single and multiple random variables	K3
CO4	Explain the concept of a random process and its classification	K2
CO5	Understand the frequency domain representation of a Random Process, and the relevance of a Random process in a communication system	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	1	1	1	2	1	1	1	2	2
CO2	3	3	2	2	2	1	2	1	2	1	2	2	2	2
CO3	3	2	2	3	1	1	1	1	2	1	2	3	2	2
CO4	3													
CO5														

COURSE CONTENT	
UNIT I	**THE RANDOM VARIABLE** Review of Probability :Joint Probability, Conditional Probability, Baye's Theorem; Definition of a Random Variable, Conditions for a function to be a Random Variable, Discrete, Continuous and Mixed Random Variable. Distribution and Density functions of Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and their properties. Conditional distribution, conditional density functions and their 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, Markov's inequality, Moment Generating Function, Characteristic Function of a Random Variable and their properties , Transformations of a Random Variable – Monotonic, Non-monotonic
UNIT III	**MULTIPLE RANDOM VARIABLES** Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density –Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, Equal and Unequal 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, Joint Gaussian Random Variables - Two Random Variables, N-Random Variables and their 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 andNondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order, Second- Order, Wide-Sense(N-Order) and Strict-Sense Stationary Processes, Time Averages and Ergodicity, Mean-Ergodic Processes, Autocorrelation, Cross-Correlation functions and their Properties. Covariance, Gaussian and Poisson Random Processes.
UNIT V	**RANDOM PROCESSES – SPECTRAL CHARACTERISTICS** Power Spectrum and its properties, relationship between Power Spectrum and Autocorrelation Function, Power Density Spectrum and its Properties, Relationship between power spectrum and cross correlation function. **LINEAR SYSTEMS WITH RANDOM INPUTS** Random Signal response of Linear Systems - system response, convolution, mean and mean-squared value of system response, autocorrelation function of response, cross-correlation functions of input and output, spectral characteristics of system response - power density spectrum, power density spectrums of input and output, band limited band pass, and narrowband processes, Quadrature components of noise and their properties.

TEXT BOOKS	
1.	Probability, Random Variables & Random Signal Principles - Peyton Z Peebles, 4th Edition, TMH,2001.
2.	Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, 4th Edition,PHI, 2002.
3.	Probability Theory and Stochastic Process- YMallikarjunaReddy, 4thEdition,University Press.Probability,Stastistics and Random Processes – K.Murugesan and P.Gurusamy
REFERENCE BOOKS	
1.	Probability Theory and Stochastic Process – B Prabhakara Rao, Oxford University Press.
2.	Probability and Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, 3rdEdition, Pearson Education.
3.	Probability Methods of Signal and System Analysis - George R.Cooper, Clave D. MC Gillem,3rdEdition, Oxford, 1999.
4.	Statistical Theory of Communication - S.P. Eugene Xavier, New Age Publications, 2003.
WEB RESOURCES	
1.	1.https://onlinecourses.nptel.ac.in/noc17_ee08

EM WAVES AND TRANSMISSION LINES

(ECE)

II B. Tech II Semester

Course Category	Professional Core	**Course Code**	**19EC4T13**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

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, reflection, and transmission of plane waves, Poynting Vector and Poynting Theorem.
4	To study the Transmission Line Equations, Loading, Distortion in transmission lines
5	To study the λ/4, λ /2, λ/8 Lines and their Impedance Transformations, to study waveguides,

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the concepts of static electric and magnetic fields.	K2
CO2	Interpret Maxwell's Equations	K3
CO3	Explain the concept of electromagnetic waves & its propagation.	K2
CO4	Differentiate between distributed and lumped parameters.	K3
CO5	Explain the functionality of a transmission line terminated with different loads.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			3						1		2	3	
CO2	3	2		2						1		1	2	
CO3	3	3		2						1			3	
CO4	3	3		2						1			3	
CO5	1	1	3	1						1			2	

COURSE CONTENT	
UNIT I	**TRANSMISSION LINES** Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless/Low Loss Characterization, Distortion – Condition for Distortionless and Minimum Attenuation Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. UHF Lines as Circuit Elements; λ/4, λ /2, λ/8 Lines – Impedance Transformations. 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** Wave Propagation in Lossless and Conducting Media. Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics. 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 Illustrative Problems.
UNIT V	**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, Continuity Equation, Relaxation Time, Illustrative Problems. **Magneto Statics :**Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Magnetic Energy. Illustrative Problems.

TEXT BOOKS	
1.	Elements of Electromagnetic – Matthew N O Sadiku, 3rd ed., Oxford University Press, 2001.
2.	Electromagnetic Waves and Radiating Systems – E C Jordan and K G Balmain, 2nd Edition, PHI, 2000
3.	Electromagnetic Waves and Transmission Line—Y Mallikarjuna Reddy, Universities Press, 2015
REFERENCE BOOKS	
1.	Electromagnetic Fields and Wave Theory –G S N Raju, Pearson Education, 2006.
2.	Transmission Lines and Networks – Umesh Sinha, Satya Prakashan (Tech. India Publications), New Delhi, 2001.
3.	Electromagnetics - John D Kraus, McGraw Hill Book Co., 1973.
WEB RESOURCES	
	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

(ECE)

II B. Tech II Semester

Course Category	Professional Core	**Course Code**	**19EC4T14**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Signals & Systems	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
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,

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Comprehend the performance of Amplitude modulation and demodulation techniques	K2
CO2	Differentiate DSB and SSB modulation schemes and their spectral characteristics	K2
CO3	Examine the performance of Angle modulation and demodulation techniques	K3
CO4	Analyze various functional blocks of Radio Transmitters and Receivers	K3
CO5	Analyze Noise Characteristics of Amplitude& Frequency modulation Techniques	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		1									2	
CO2	3	3		1									2	
CO3	3	3	1	1									2	
CO4	3	1	1	1		1							2	
CO5	3	2	1	1		1							2	

COURSE CONTENT

UNIT I	**AMPLITUDE MODULATION** Introduction to communication system, Need for modulation, FrequencyDivision Multiplexing , Amplitude Modulation, Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, square law Modulator, Switching modulator, Detection of AM Waves; Square law detector, Envelope detector.
UNIT II	**DSB & SSB MODULATION** Double side band suppressed carrier modulators, time domain and frequencydomain description, Generation of DSBSC Waves, Balanced Modulators, Ring Modulator, Coherent detection of DSB-SC Modulated waves, COSTAS Loop. 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.
UNIT III	**VSB MODULATION & ANGLE MODULATION**: **Vestigial side band modulation:** Frequency description, Generation of VSB Modulated wave, Time domain description, Envelope detection of a VSB Wave pulse Carrier, Comparison of AM Techniques, Applications of different AM Systems. **Frequency Modulation:** Single tone frequency modulation, SpectrumAnalysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM. Pulse Modulation Techniques: PAM,PWM,PPM (Qualitative Treatment)
UNIT IV	**TRANSMITTERS & RECEIVERS** Radio TransmitterClassification of Transmitter, AM Transmitter, Effectof feedback on performance of AM Transmitter, FM Transmitter – Variable reactance type and phase modulated FM Transmitter, frequency stability in FM Transmitter. **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 V	**NOISE** Noise in Analog communication Systems: Noise inAM-SC System, Noise in AM-FC system, Noise in Frequency Modulation System, Threshold effect in Frequency Modulation System, Pre-emphasis & de-emphasis

TEXT BOOKS	
1.	Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe, TMH, 3rd Edition 2007.
2.	Principles of Communication Systems - Simon Haykin. 2nd Edition, John Wiley 2007.
3.	Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH, 2007.
REFERENCE BOOKS	
1.	Communication Systems – B P Lathi, B S Publication, 2006.
2.	Analog communication systems - Dr.sanjay Sharma, 6th Edition , S K kataria and sons 2016.
3.	Electronics & Communication System - George Kennedy and Bernard Davis, 4th Edition TMH 2009.
WEB RESOURCES	
	https://www.smartzworld.com/notes/analog-communication-system-pdf-notes-ac/ https://nptel.ac.in/courses/117105143/15

COMPUTER ARCHITECTURE AND ORGANIZATION (ECE)

II B. Tech II Semester

Course Category	Professional Core	**Course Code**	**19EC4T15**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	STLD	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Examine functional units, bus structure and analyzing the data representations. (Analyze)
2	Evaluation of micro operations of ALU. (Evaluate)
3	Design of CPU and micro programmed control units.(Create)
4	Applying algorithms to perform arithmetic operations on fixed point and floating point. (Apply)
5	Analyze the I/O interfaces and multiprocessors architectures. (Analyze)

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the architecture of modern computer.	
CO2	Explain the role of CPU in performing arithmetic and logical operations.	
CO3	Demonstrate the micro-operations and instructions of the target computer.	
CO4	Explain the concepts of memory mapping techniques in a computer.	
CO5	Demonstrate the interfacing of various I/O devices.	

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	1	1
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	2	1	-	-	-	-	-	-	-	-	-	1
CO5	3	3	3	1	-	-	-	-	-	-	-	-	1	-

COURSE CONTENT	
UNIT I	**INTRODUCTION TO COMPUTER ORGANIZATION AND ARCHITECTURE** Structure and function, designing for performance, components of a computer system, computer functions, Interconnection structures, Bus interconnection,Instruction set architecture design and hardware/software interface. Instruction types, addressing modes, basic I/O operations and load/store architectures. Instruction and Instruction sequencing, conditional branches, Logic instructions, Shift and Rotate instructions with various examples.
UNIT II	**UNIT – II** **CENTRAL PROCESSING UNIT** CPU structures and function, Arithmetic and Logic Unit, Instruction formats, Data transfer and manipulation, CISC and RISC architectures. Organization of single- and multi-cycle RISC microprocessors. Data path and control logic. Micro-programming. Modern multi-core (Multiprocessing) architectures. Programming for multi-core architectures – Parallelism
UNIT III	**CONTROL UNIT** Control memory, Address sequencing, computer configuration, microinstructions, microprogram sequencing, wide branch addressing, microinstructions with next-address field. Symbolic microinstructions, symbolic microprogram, control unit operations, Design of control unit **TECHNIQUES FOR IMPROVING COMPUTER PERFORMANCE** Pipelining and interleaving, pipelining impact on the ISA and system architecture, speed up achieved through pipelining, pipeline hazards and forwarding, interlocks, and branch delay slots. Parallel processing, RISC pipeline, vector processing and array processing,Super scalar design
UNIT IV	**MEMORY SYSTEMS AND MANAGEMENT** Basic memory circuits, ROM, RAM, EEPROM, Flash Memory, Cache memory, memory hierarchies, caches: organization, size, implementation and Improve memory performance with caches, mapping functions, interleaving, replacement algorithm, write policy and no of caches. Secondary storage: Magnetic Hard Disk, Optical Disks, Solid State Disks and Arrays, Redundant arrays of inexpensive disks (RAID),Virtualization and sharing computers – Memory management, virtual memory, time sharing and process management
UNIT V	**INPUT/OUTPUT ORGANIZATION AND MULTI PROCESSING SYSTEMS** Peripheral devices, I/O devices/modules –Access, interfaces, modes of transfer – programmed, interrupt driven and DMA. Interrupt hardware – Enabling and disabling, handling multiple devices, I/O processors, Data communication processor. Buses – Synchronous Bus, Asynchronous bus, Interface Circuits, Standard I/O interface – PCI, USB etc.,Multiprocessing systems – Multiprocessor and its characteristics, interconnection structures for multiprocessors, inter processor communication and synchronization

TEXT BOOKS	
1.	Computer Organization, Carl Hamacher, ZvonksVranesic, SafeaZaky, 5/e, McGraw Hill.
2.	Computer System Architecture, M.Morris Mano, 3/e, Pearson/PHI
3.	Computer Organization and Architecture – William Stallings, 6/e, Pearson/PHI
REFERENCE BOOKS	
1.	Structured Computer Organization – Andrew S. Tanenbaum, 4/e, PHI/Pearson
2.	Fundamentals or Computer Organization and Design, - SivaraamaDandamudi Springer Int. Edition
3.	Computer Organization and Architecture-John P.Hayes, 5th edition, MC GrawHill
WEB RESOURCES	
.	https://www.tutorialspoint.com/videos/computer_organization/index.htm http://nptel.iitm.ac.in/video.php?subjectId=106106092 https://www.reference.com/technology/computer-organization-36c3a064b20f9b33

Object Oriented Programming through Java

(Common to CE, ME, EEE, ECE, CSE, IT)

Course Category	Professional Core	**Course Code**	19CS4T05
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Exposure to Programming for Problem Solving using C	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand how to use Java to write applications.
2	To impart primitive data types in Java and programming constructs.
3	To make use of Java Classes and Objects, methods and constructors.
4	To understand the concepts of Inheritance, Interfaces and Packages.
5	To implement Java programs using exceptions and multithreading.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Apply the fundamentals of Java to solve problems	L3
CO2	Differentiate the application of decision and iteration control structures	L2
CO3	Implement classes and method overloading concepts	L3
CO4	Apply the concepts of inheritance and packages	L3
CO5	Implement Java programs using exceptions and multithreading	L3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	0	0	0	0	0	0	0	3	3	2
CO2	3	3	3	2	3	0	0	0	0	0	0	0	3	3	2
CO3	3	3	3	3	3	0	0	0	0	0	0	0	3	3	2
CO4	3	3	3	3	3	0	0	0	0	0	0	0	3	3	2
CO5	3	3	3	3	3	0	0	0	0	0	0	0	3	3	2

COURSE CONTENT	
UNIT I	**Introduction to JAVA:** The History of Java, Java Virtual Machine, Java Buzzwords, Evolution of Java, An overview of Java, Object Oriented Programming and its principles, First Java Program, Lexical Issues-Identifiers, Java Keywords, Java Primitive Data types, Variables, Type Conversion and Casting, Arrays. **Programming Constructs:** Operators- Arithmetic, Bitwise, Relational, Boolean Logical, Assignment, ? Operator, Operator Precedence, Control Statements – Selection, Iteration and Jump Statements.
UNITII	**Classes and Objects:**Class Fundamentals, declaring Objects, Introducing Methods, Constructors, The this Keyword, Garbage collection. **A Closer look at Methods and Classes:** Overloading Methods, using objects as parameters, returning objects, Introducing Access Control, Understanding static, introducing final, Nested and Inner Classes, Exploring the String class, using Command-Line Arguments.

UNITIII	**Inheritance:** Types of Inheritance, Using super, Method Overriding, Using Abstract class, Using final with Inheritance. **Interfaces& Packages:** Interfaces, Multiple Inheritance Issues, Defining a Package, Finding Packages and CLASSPATH, Access protection, Importing packages, package example, Introducing to ***java.lang*** and ***java.io*** packages.
UNITIV	**Exceptions:** Introduction, Exception handling fundamentals, Exception types, using try and catch, Multiple catch clauses, nested try statements, throw, throws, finally block, Java's Built-in-Exceptions, user defined exception, Chained Exceptions, using Exceptions.
UNITV	**Multi-Threading:**The Java Thread Model, the Main Thread, Creating a Thread, Multiple threads, Using isAlive() and join(), Thread priorities, Synchronization, Interthread Communication, Suspending, Resuming threads and Stopping Threads, using Multithreading.

TEXT BOOKS	
1.	The Complete Reference Java, 9ed, Herbert Schildt, TMH
2.	Programming in JAVA, Sachin Malhotra, Saurabh choudhary, Second Edition, Oxford.
REFERENCE BOOKS	
1.	Object oriented programming with JAVA, Essentials and Applications, Raj KumarBuyya,Selvi,Chu TMH
2.	Core Java Volume 1.Fundamentals, 8ed, Cay S.Horstmann, Gray Cornell, Pearson.
3.	Advanced Programming in Java2: Updated to J2SE6 with Swing, Servlet and RMI, K.Somaundaram.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/106105191/
2.	https://docs.oracle.com/javase/tutorial/java/index.html
3.	https://www.w3schools.com/java/

ELECTRONIC CIRCUIT ANALYSIS LABORATORY (ECE)

II B.Tech II Semester

Course Category	Lab Course	**Course Code**	**19EC4L04**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	EDC	**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 100

COURSE OBJECTIVES	
1	
2	
3	

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze the frequency response of multistage amplifiers.	K2
CO2	Explain the effect of feedback on the performance of the amplifier.	K2
CO3	Design Oscillators and Power amplifiers for the given specifications.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3										1		3	3
CO2	3	2									2	1	2	3
CO3	3	2	2								3		2	3

LIST OF EXPERIMENTS:

Any 10 of the following experiments are to be conducted

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 ASeries-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. ClassASeries-Fed Power Amplifier.
9. Class B Complimentary Symmetry Amplifier.
10. Single Tuned Voltage Amplifier

References – Lab Manuals will be provided

ANALOG COMMUNICATIONS LAB
(ECE)
II B.Tech II Semester

Course Category	Lab Course	**Course Code**	**19EC4L05**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	EDC	**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 100

COURSE OBJECTIVES	
1	To study various modulation and demodulation techniques of AM, FM
2	To study the characteristics of Pre-emphasis and De-emphasis circuits
3	Verification of sampling thermo and pulse modulation techniques

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze various Analog modulation & demodulation techniques.	K2
CO2	Able to demonstrate the process of discretization of a continuous signal.	K2
CO3	Will be able to demonstrate various receiver characteristics.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**-**
CO2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**-**
CO3	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**2**	**-**

LIST OF EXPERIMENTS:

Any 10 of the following experiments are to be conducted

LIST OF EXPERIMENTS (Ten experiments to be done - **The students have to calculate the relevant parameters**) - (a. Hardware, b. MATLAB Simulink, c. MATLAB Communication tool box)

1. Amplitude Modulation & Demodulation.
2. AM - DSB SC - Modulation & Demodulation.
3. Spectrum Analysis of Modulated signal using Spectrum Analyzer
4. Diode Detector
5. Pre-emphasis & De-emphasis
6. Frequency Modulation & Demodulation.
7. AGC Circuits
   1. Verification of Sampling Theorem.
   2. Pulse Amplitude Modulation & Demodulation.
   3. Radio receiver characteristics.

EQUIPMENTS &SOFTWARE REQUIRED SOFTWARE

i) Computer Systems with latest specifications
ii) Connected in Lan (Optional)
iii) Operating system (Windows 7)
iv) Simulations software (Simulink & MATLAB)

EQUIPMENT

1. RPS - 0 – V
2. CRO - 0 – 20 M Hz.
3. Function Generators - 0 – 1 M Hz
4. Components
5. Multimeters
6. Spectrum Analyzer

References – Lab Manuals will be provided

Professional Ethics and Human Values (Common to all branches)

CourseCategory	Humanities including Management	**COURSE CODE**	19HM4T07
CourseType	Theory	**Lecture-Tutorial-Practice**	2 -0 -0
Prerequisites		**Total Marks (Internal Assessment)**	100

Course Outcomes		**Blooms Taxonomy Level**
On successfulcompletionofthecourse, thestudentwillbeableto		
CO 1	Understand different concepts in Professional Ethics and Human Values.	Understanding
CO 2	Apply ethical principles to resolve the problems that arise in work place.	Applying
CO 3	Make use of Engineers rights to fulfill their responsibilities.	Applying
CO 4	Understand the responsibility of an engineer in designing safety.	Understanding
CO 5	Analyze the social media accounts in order to create and maintain a positive digital footprint.	Analyzing

Contribution of Course Outcomes towards achievement of Program												
Outcomes: 1 – Low, 2 - Medium, 3 – High												
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO8**	**PO 9**	**PO1 0**	**PO 11**	**PO 12**
CO1	0	0	2	0	0	3	2	3	0	2	0	1
CO2	0	0	2	0	0	2	2	3	0	1	0	2
CO3	0	0	2	0	0	3	2	3	0	2	0	1
CO4	0	0	2	0	0	3	2	3	0	2	0	1
CO5	0	0	2	0	0	2	2	3	0	1	0	1

Course Content:

UNIT - I
Professional Ethics and Human values:
Ethics -History of Ethics-Types of Ethics, Professional Ethics and its forms - Morals, Values – Integrity –Civic Virtue –Respect for others – Living Peacefully – Caring – Sharing – Honesty – Courage – Value time –Co-operation – Loyalty- Collegiality-Commitment – Empathy – Self-confidence – Spirituality- Character.

UNIT - II
Engineering & Organization Ethics:
Engineering Ethics-Meaning & Purpose of Engineering Ethics- Consensus and Controversy –

Work Place Ethics and Business Ethics –Ethics in HRM, Finance & Marketing – Ethical Theories-Meaning & Uses of Ethical Theories-Theories of moral Development-Kohlberg's Theory – Gilligan's Argument –Heinz's Dilemma.

UNIT - III

Engineers Responsibilities and Rights:

Key Characteristics of Engineering Professionals – Professional Roles to be played by an Engineer - Ethical egoism-Collective bargaining-Confidentiality- Acceptance of Bribes/Gifts when is a Gift and a Bribe-examples of Gifts v/s Bribes-Whistle Blowing and its types-when should it be attempted-preventing whistle blowing.

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

Ethical issues in Social Media:

Social Media- Various Social Media Platforms: Google, Facebook, YouTube, Instagram -Social Media set-up and Uses-Ethical use of Social media-Effects of Social Media on Public- Social Media (vs) News- Social Media Fame and Reputation-Trolling, Harassing, and Hating on Social Media-Legal Aspects of Social Media.

REFERENCES :

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, DharanikotaSuyodhana- 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 Schinzinger -Tata McGraw- Hill - 2003
7. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

Web Resources:

1. https://study.com/academy/lesson/ethical-issues-in-internet-social-media-marketing.html
2. https://www.tutorialspoint.com/engineering_ethics/engineering_ethics_rights_of_engineers
3. https://link.springer.com/article/10.1007/s11948-997-0039-x

INTEGRATED CIRCUITS AND APPLICATIONS

(ECE)

III B Tech I Semester

Course Category	Professional Core	**Course Code**	19EC5T16
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Electronics Circuit Analysis	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
The student will:	
1	To understand the basic operation &performance parameters of differential amplifiers.
2	To understand & learn the measuring techniques of performance parameters of Op-Amp
3	To learn the linear and non-linear applications of operational amplifiers.
4	To understand the analysis & design of different types of active filters using op-amps
5	To learn the internal structure, operation and applications of different analog ICs
6	To Acquire skills required for designing and testing integrated circuits

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Design circuits using operational amplifiers for various applications.	K3
CO2	Analyze and design amplifiers and active filters using Op-amp.	K4
CO3	Diagnose and trouble-shoot linear electronic circuits.	K2
CO4	Understand the gain-bandwidth concept and frequency response of the amplifier configurations.	K2
CO5	Understand thoroughly the operational amplifiers with linear integrated circuits.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	2	1
CO2	1	2	3	2	-	-	-	-	-	-	-	-	1	2
CO3	1	2	3	2	-	-	-	-	-	-	-	-	1	2
CO4	1	1	2	1	-	-	-	-	-	-	-	-	1	2
CO5	1	1	2	1	-	-	-	-	-	-	-	-	2	1

COURSE CONTENT	
UNIT-I	**Introduction:** Internal Block Diagram of various stages of Op-Amp and Roll of each Stage. Differential Amplifier using BJTs and With RE DC and AC Analysis, Basic Current Mirror Circuit, Improved Version of current mirror circuit, current repeated circuit, Wilson current source. OP-Amp Block Diagram (Symbolic Representation), Characteristics of Op-Amp, Ideal and Practical Op-Amp specifications, DC and AC Characteristics, Definitions of Input and Output Off-set voltage and currents slowrate, CMRR,PSRR.etc,MeasurementsofOp-AmpParameters.Three-TerminalVoltage Regulators 78xx& 79xx Series, current Booster, adjustable voltage, Dual Power Supply with 78xx &79xx, Review on IC packages, technologies and fabrication.

UNIT-II	**LINEARandNON-LINEARAPPLICATIONSOFOP-AMPS:**InvertingandNon-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier, AC amplifier, V to I, I to V converters, Buffers. Non- Linear function generation, Comparators, Multivibrators, Triangular and Square wave generators, Log and Anti log Amplifiers, Precision rectifiers.
UNIT-III	**ACTIVEFILTERS, ANALOG MULTIPLIERS AND MODULATORS**: Design& Analysis ofButterworthactivefilters–1storder,2ndorderLPF,HPFfilters.Band pass, Band reject and all pass filters. Four Quadrant Multiplier, IC 1496, Sample & Hold circuits.
UNIT-IV	**TIMERS & PHASE LOCKED LOOPS**: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger; PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of PLL
UNIT-V	**DIGITAL TO ANALOG AND ANALOG TO DIGITALCONVERTERS**: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel ComparatortypeADC,countertypeADC,successiveapproximationADCanddual slope ADC.DAC and ADC Specifications, Specifications AD 574 (12-bit ADC).

TEXT BOOKS	
1.	Linear Integrated Circuits - D. Roy Choudhury, New Age International (p)Ltd, 2nd Edition, 2003.
2.	Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987.
REFERENCE BOOKS	
1.	Operational Amplifiers & Linear Integrated Circuits - Sanjay Sharma, SK Kataria& Sons; 2nd Edition, 2010
2.	Operational Amplifiers & Linear Integrated Circuits - R.F.Coughlin& Fredrick Driscoll, PHI, 6th Edition, 2000.
3.	Operational Amplifiers & Linear ICs - David A Bell, Oxford Uni. Press, 3rd Edition, 2011.
WEB RESOURCES:	
1	http://nptel.ac.in/courses/1171070

DIGITAL COMMUNICATIONS

(ECE)

III B Tech I Semester

Course Category	Professional core	**Course Code**	19EC5T21
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Analog Communications	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Understand the pulse digital modulation systems such as PCM, DPCM and DM.
2	Categorize various digital modulation techniques.
3	Evaluate the concept of transmission process, error calculation and concepts of matched filters
4	Formulate the errors present in Block codes, cyclic codes.
5	Interpret and estimate the errors present in convolution codes.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
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	Analyze block codes and cyclic codes for the reliable transmission of digital information over the channel.	Analyze
CO5	Implement convolution codes for digital communication applications.	Apply

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2			1							2	2	2
CO2	1	2			1							2	2	2
CO3	1	2			1							2	2	2
CO4	1	2			1							2	2	2
CO5	1	2			1							2	2	2

COURSE CONTENT	
UNIT I	**Elements of Digital Communication Systems:** Model of Digital Communication Systems, Digital Representation of Analog Signal, Certain issues in Digital Transmission, Advantages of Digital Communication Systems, Bandwidth-S/N tradeoff, Hartley Shannon Law, Sampling Theorem

UNIT II	**Pulse Code Modulation:** PCM Generation and Reconstruction, Quantization noise, Non uniform Quantization and Companding, DPCM, Adaptive DPCM, DM and Adaptive DM. Noise in PCM and DM.
UNIT III	**Digital Modulation Techniques:** Introduction, ASK, ASK Modulator, Coherent ASK Detector, Non-Coherent ASK Detector, FSK, Bandwidth and Frequency Spectrum of FSK. Non coherent FSK Detector, Coherent FSK Detector, FSK Detection Using PLL, BPSK, Coherent PSK Detection, QPSK, Differential PSK.
UNIT IV	**Baseband transmission and Optimal Reception of Digital Signal:** Pulse shaping for optimum transmissions. A Baseband Signal Receiver, Probability of Error. Optimum Receiver, optimal of Coherent Reception. Signal Space Representation and Probability of Error, eye diagrams, Cross talk.
UNIT V	**Spread Spectrum Modulation:** Use of Spread Spectrum, Direct Sequence Spread Spectrum (DSSS), Code Division Multiple Access, Ranging using DSSS. Frequency Hopping Spread Spectrum, PN - sequences: Generation and Characteristics. Synchronization in Spread Spectrum Systems

TEXT BOOKS	
1.	Digital and Analog Communication Systems - Sam Shanmugam, John Wiley, 2005.
2.	Digital communications - Simon Haykin, John Wiley, 2005.
REFERENCE BOOKS	
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 RESOURCES	
1.	http://www.nptelvideos.in/2012/12/digital-communication.html

ANTENNAS AND PROPAGATION

(ECE)

III B. Tech I Semester

Course Category	Professional Core	**Course Code**	**19EC5T22**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	EMTL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Study antenna fundamentals, Obtain antenna parameters for wire antenna.
2	Use Principle of Pattern Multiplication for various arrays
3	Study Broad band antennas.
4	Study Reflectors, VHF, UHF and Microwave antennas
5	Understand radio wave propagation.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand antenna fundamentals, Obtain antenna parameters for wire antenna.	K2
CO2	Apply knowledge of Principle of Pattern Multiplication to various arrays	K3
CO3	Apply knowledge of antenna fundamentals to Broad band antennas	K3
CO4	Apply knowledge of antenna fundamentals to Reflectors, VHF, UHF and Microwave antennas	K3
CO5	Infer the characteristics of radio wave propagation in the atmosphere.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	1	-	-	-	-	-	-	-	-	-	2	2
CO2	1	1	1	-	-	-	-	-	-	-	-	-	2	1
CO3	2	1	2	1	-	-	1	-	-	-	-	-	2	2
CO4	2	1	2	1	-	-	1	-	-	-	-	-	2	2
CO5	**1**	1	1	1	-	-	-	-	-	-	-	-	2	2

COURSE CONTENT	
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-illustrated Problems. Antenna Theorems – Applicability and Proofs for equivalence of directional characteristics.
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, Small Loops – Characteristics, Comparison of far fields of small loop and short dipole.
UNIT III	**ANTENNA ARRAYS:** 2 element arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End-fire Arrays, Derivation of their characteristics and comparison- Illustrative problems Folded Dipoles and their characteristics, Arrays with Parasitic Elements, Yagi-Uda Array, Illustrative problems. **NON-RESONANT RADIATORS:** Introduction, Long wire TWA-patterns, Broadband Antennas: Helical Antennas –Significance, Geometry, basic properties, Design considerations for monofilar helical antennas in Axial Mode and Normal Modes (Qualitative Treatment).
UNIT IV	**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. Micro strip Antennas-Introduction, Features, Advantages and Limitations. Rectangular Patch Antennas –Geometry and Parameters, Impact of different parameters on characteristics. Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns; Lens Antennas – Geometry, Features, Dielectric Lenses and Zoning, Applications.
UNIT V	**WAVE PROPAGATION:** Concepts of Propagation – frequency ranges and types of propagations. Ground Wave Propagation–Characteristics, Wave Tilt, Flat and Spherical Earth Considerations. 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.

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.
REFERENCE BOOKS	
1.	Antenna Theory - C.A. Balanis, John Wiley and Sons, 2nd Edition, 2001.
2.	Antennas and wave propagation- Sisir K Das, Annapurna Das, TMH,2013
3.	Antennas and Wave Propagation, G. S. N. Raju, Pearson Education, 2006.

MICROPROCESSORS and MICROCONTROLLERS

(ECE)

III B. Tech I Semester

Course Category	Professional Core	**Course Code**	**19EC5T18**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	STLD, Computer Fundamentals	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To Study architecture and memory organization of 8086.
2	To Learn Programming concepts of8086.
3	To Study the interfacing of 8086 with Peripheral devices (I/O devices).
4	To Learn the programming concepts of 8051microcontroller.
5	To Study architecture and features of ARM Processor and its Applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Demonstrate the concepts of architecture and key features of 8086	K2
CO2	Develop Assembly Language Programs using 8086.	K3
CO3	Understand Interfacing for I/O devices like Stepper motor, LED displays with 8086.	K2
CO4	Understand Interface I/O devices like Keyboard, display units with 8051.	K2
CO5	Illustrate the concepts of ARM Processor in embedded real time project applications.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	-	-	-	1	2
CO2	1	2	2	-	-	-	-	-	-	-	-	-	1	2
CO3	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	1	-	-	-	-	-	-	-	-	1	2	2
CO5	2	1	2	-	-	-	-	-	-	-	-	1	2	2

COURSE CONTENT	
UNIT I	**Introduction:** Basic Microprocessor architecture, Harvard and Von Neumann architectures with examples, Microprocessor Unit versus Microcontroller Unit, CISC and RISCarchitectures, 8085 architecture. **8086 ARCHITECTURE:** Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interruptsandinterruptresponses,8086systemtiming,minimummodeandmaximum 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	**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 to 8051: A/D and D/A Convertors, Stepper motor interface, keyboard, LCD Interfacing, Traffic light control.
UNIT V	**ARM Architectures and Processors:** ARM Architecture, ARM Processors Families, ARM Cortex-M Series Family, ARM Cortex-M3 Processor Functional Description, functions and interfaces. Programmers Model – Modes of operation and execution, Instruction set summary, System address map, write buffer, bit-banding, processor core register summary, exceptions. ARM Cortext-M3 programming – Software delay, Programming techniques, Loops, Stack and Stack pointer, subroutines and parameter passing, parallel I/O, Nested Vectored Interrupt Controller – functional description and NVIC programmers' model.

TEXT BOOKS	
1.	Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition,1994.
2	The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; Pearson, 2nd Edition, 2011
REFERENCE BOOKS	
1.	Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm Education Media,2017.
2.	Cortex -M3 Technical Reference Manual
3.	The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by Joseph You.
WEB RESOURCES	
1.	https://www.nptel.ac.in/ downloads/106108100/
2.	enhanceedu.iiit.ac.in/wiki/images/ARM_architecture.pdf

Pulse and Digital Circuits

(ECE)

III B. Tech I Semester

Course Category	**Professional Elective**	**Course Code**	**19EC5T23**
Course Type	**Theory**	**L-T-P-C**	**3-0-0-3**
Prerequisites	**EDC, STLD.**	**Internal Assessment Semester** **End Examination** **Total Marks**	30 70 100

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

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Design RC Circuits for altering Non-sinusoidal signal Design various types of clippers & clampers using diodes.	K3
CO2	Apply the basic concepts of design different logic gates using different logic Families	K2
CO3	Design different multivibrators like bi-stable, constable and Astable multi's	K3
CO4	Design different voltages time base generators.	K2
CO5	Design of memory elements and free running oscillators	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2	-	-	-	-	-	-	-	-	-	2	-
CO2	1	1	1	2	2	-	-	-	-	-	-	2	2	-
CO3	1	1	2	-	-	-	-	-	-	-	-	2	2	-
CO4	1	1	2	1	-	-	-	-	-	-	-	-	2	-
CO5	1	1	2	2	-	-	-	-	-	-	-	2	2	-

COURSE CONTENT	
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, RL and RLC circuits and their response for step input. **Non-Linear WaveShaping:** Diode clippers, Transistorclippers, clippingattwo independentlevels,Transfercharacteristicsofclippers,clampingoperation,clamping
	circuits using diode with different inputs, Clamping circuit theorem, practical clamping circuits.
UNIT II	**Switching Characteristics of Devices:** Diode as a switch, 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 III	**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 IV	**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 bootstrap time base generator.
UNIT V	**Synchronization and Frequency Division:** Principles of Synchronization, Frequency division in sweep circuit, Astable relaxation circuits, Monostable relaxation circuits, Synchronization of a sweep circuit with symmetrical signals.

TEXT BOOKS	
1.	Pulse, Digital and Switching Waveforms by J Millman, H Taub and M S Prakash Rao, McGraw Hill, 2007.
2.	Pulse and Digital Circuits by A Anand Kumar, 2nd Edition, PHI, 2012.
REFERENCE BOOKS	
1.	Solid state pulse circuits by David A Bell, 4th edition, PHI, 2002.
2.	Pulse, Digital Circuits and Computer fundamentals by R Venkataramana, Dhanpat Rai Publications, 2010.
3.	Wave Generation and shaping – L.Strauss, McGraw Hill, 1981.
WEB RESOURCES	
1	nptel.ac.in/course/117106086/1

DIGITAL SYSTEM DESIGN

(ECE)

III B. Tech I Semester

Course Category	**Professional Elective**	**Course Code**	19EC5T24
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	STLD	**InternalAssessment** **Semester EndExamination** **TotalMarks**	30 70 100

COURSE OBJECTIVES	
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 logic under 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, Memories using VHDL.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze logic circuits using hardware description language for digital applications.	K4
CO2	Synthesize digital logic circuits using various simulation techniques.	K3
CO3	Implement Basic Logic circuits using CMOS and TTL their interfacing.	K4
CO4	Design combinational logic circuits using VHDL	K4
CO5	Design Counters using various types of Flip-Flops.	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	-	-	-	-	-	-	-	-	-	1	1
CO2	1	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	1	2	-	-	-	-	-	-	-	2	1
CO5	3	3	2	1	2	-	-	-	-	-	-	-	2	1

COURSE CONTENT	
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.
UNIT IV	**COMBINATIONAL LOGIC DESIGN:** Adders and Subtractors, Ripple Adder, Look Ahead Carry Generator, Binary Parallel Adder, Binary Adder-Subtractor, ALU, Decoders, Encoders, Multiplexers and De-Multiplexers, Parity Circuits, Comparators, Multipliers, 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. MSI Registers, Design considerations with relevant Digital ICs, modeling of circuits by using VHDL. **Memories:** ROM, Static RAM, Dynamic RAM, Internal structure, timing, synchronous RAMs

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 ZvonkoVranesic, Tata McGraw Hill, 2nd edition.
REFERENCE BOOKS	
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.
3.	Digital System Design Using VHDL, Charles H. Roth Jr., PWS Publications, 2008.
WEB RESOURCES	
1.	http://www.nptelvideos.in/2012/12/digital-systems-design

INFORMATION THEORY and CODING

(ECE)

III B. Tech I Semester

Course Category	**Professional Elective**	**Course Code**	**19EC5T25**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Digital Communications	**InternalAssessment** **Semester EndExamination** **TotalMarks**	30 70 100

COURSE OBJECTIVES	
1	To acquire the knowledge in measurement of information and errors.
2	Understand the importance of various codes for communication systems
3	To design encoder and decoder of various codes.
4	To know the applicability of source and channel codes

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Learn measurement of information and errors.	K4
CO2	Obtain knowledge in designing various source codes and channel codes	K3
CO3	Design encoders and decoders for block and cyclic codes	K4
CO4	Understand the significance of codes in various applications	K2
CO5	Understand the significance of BCH Codes	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	-	-	-	-	-	-	-	-	-	1	1
CO2	1	2	3	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	1	1

COURSE CONTENT	
UNIT I	**INFORMATION THEORY AND SOURCE CODING** Uncertainty, information, entropy and its properties, entropy of binary memory less source and its extension to discrete memory less source, source coding theorem, data compression, prefix coding, Huffman coding, Lempel-Ziv coding, Source with memory and its entropy.
UNIT II	**DISCRETE CHANNELS** Binary Symmetric Channel, mutual information & its properties, Channel capacity, channel coding theorem and its application to BSC, Shannon's theorem on channel capacity, capacity of a channel of infinite bandwidth, bandwidth - S/N trade off, practical communication systems in light of Shannon's theorem, Fading channel, channels with memory.
UNIT III	**Linear Block Codes:** Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

UNIT IV	**Cyclic Codes:** Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.
UNIT V	**Convolutional Codes:** Encoding of Convolutional Codes- Structural and Distance Properties, state, tree, trellis diagrams, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system, BCH Codes, Minimum distance and BCH bounds, Decoding procedure for BCH codes,

TEXT BOOKS	
1.	Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc 2014.
2.	Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing 1989
REFERENCE BOOKS	
1.	Digital Communications- John G. Proakis, 5th ed., , TMH 2008.
2.	Introduction to Error Control Codes-Salvatore Gravano-oxford
3.	Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Edition, 2009, TMH.

ADVANCED COMPUTER ARCHITECTURE (ECE)

III B. Tech I Semester

Course Category	Professional Elective	**Course Code**	19EC5T26
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	CAO	**InternalAssessment** **Semester EndExamination** **TotalMarks**	30 70 100

COURSE OBJECTIVES	
1	To impart the concepts and principles of parallelism and advanced computer architectures.
2	To analyze performance improvement of advanced processors
3	To understand the Concept of pipelining and memory organizations
4	To understand the Concept of scalar & vector processors
5	To develop the design techniques of Scalable and multithreaded Architectures

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Demonstrate concepts of parallelism.	K3
CO2	Interpret performance of advanced processors.	K3
CO3	Know the different pipeline designs and memory organizations	K4
CO4	Gain knowledge on scalar and vector processors	K2
CO5	Understand the design techniques of scalable and multithreaded architectures	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	**2**	**2**	**3**	-	-	-	-	-	-	-	-	-	1	**2**	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO5	**2**	**2**	**2**	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	Theory of Parallelism: Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and Multi computers, Multi vector and SIMD Computers, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnectArchitectures.

UNIT II	Principles of Scalable performance: Principles of Scalable performance, Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches, Hardware Technologies, Processes and Memory Hierarchy, Advanced Processor Technology,Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.
UNIT III	Bus Cache and Shared memory: Bus Cache and Shared memory, Backplane bus systems, Cache Memory organizations, Shared- Memory Organizations, Pipelining and superscalar techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, super scalar pipeline design.
UNIT IV	Parallel and Scalable Architectures: Parallel and Scalable Architectures, cache coherence and synchronization mechanism, Three Generations of Multi-computers, Message-passing Mechanisms, Vector Processing Principles, Compound Vector processing, SIMD computer Organizations.
UNIT V	Scalable: Scalable, Multithreaded and Dataflow Architectures, Latency-hiding techniques, Principles of Multithreading, Fine-Grain Multi computers, Scalable and multithreaded Architectures, Dataflow and hybrid Architectures.

Text Books	
1.	Advanced Computer Architecture Second Edition, Kai Hwang, Tata McGraw Hill Publishers.
2.	Computer Architecture, Fourth edition, J. L. Hennessy and D.A. Patterson. ELSEVIER.
Reference Books	
1.	Advanced Computer Architectures, S.G. Shiva, Special Indian edition, CRC, Taylor &Francis
2.	Computer Architecture, B. Parhami, Oxford Univ. Press.
3.	Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education

INTEGRATED CIRCUITS and APPLICATIONS LABORATORY

(ECE)

III B. Tech I Semester

Course Category	Professional Core	**Course Code**	19EC5L06
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Electronics Circuit Analysis	**InternalAssessment** **Semester EndExamination** **TotalMarks**	25 50 75

COURSE OBJECTIVES	
The student will:	
1	to teach the linear and non-linear applications of operational amplifiers (741)
2	Students are made familiar with theory and applications of 555 timers.
3	Design analog circuits of different applications using PLL and VCO.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	have a thorough understanding of operational amplifier	K2
CO2	to design circuits using operational amplifiers for various applications.	K4
CO3	Demonstrate their knowledge by designing analog circuits	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2		2							2	3	2
CO2	2	1	2		2							2	2	2
CO3	3	2	2		2							2	2	2

List of Experiments to be conducted:

1. **Study of ICs – IC 741, IC 555, IC 565, IC 566, IC 1496 – functioning, Parameters and Specifications**
2. **OP AMP Applications – Inverting amplifier, non-inverting amplifier and voltagefollower.**
3. **Design an Adder, Subtractor using Op-Amp for givenspecifications**
4. **Design Inverting and Non-Inverting Comparator usingOp-Amp.**
5. **Design an Integrator and Differentiator using Op-Amp for givenspecifications.**
6. **Design an LPF and HPF (first order) using Op-Amp and obtain its frequency response and bandwidth.**
7. **Design an Oscillator Circuits – Phase Shift and Wien Bridge Oscillators usingOp-Amp**
8. **Design a Function Generator using multipleOp-Amp.**
9. **ADC using IC 0809 & DAC using IC 741 circuits.**
10. **Design an Astable Multivibrator and Monostable Multivibrator Using 555 timer.**
11. **Obtain lock range and capture range for the given Phased Locked Loop IC.**
12. **Frequency translation using Phased Locked Loop.**
13. **Design Voltage Controlled Oscillator for given IC and obtain frequency conversion**

DIGITAL COMMUNICATIONS LABORATORY

(ECE)

III B. Tech I Semester

Course Category	Professional core	**Course Code**	19EC5L08
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Analog Communications	**InternalAssessment** **Semester EndExamination** **TotalMarks**	25 50 75

COURSE OBJECTIVES	
1	Understand the conversion of analog to digital pulse modulation systems such as PCM, DPCM and DM.
2	Observe the various digital modulation techniques.
3	Find out the error detection using different coding techniques

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Distinguish the performance of analog to digital pulse modulation techniques	Analyze
CO2	Interpret the variation in digital modulation techniques like ASK, FSK, PSK etc.	Understand
CO3	Observe the block codes and cyclic codes for the reliable transmission of digital information over the channel.	Evaluate

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2			1							2	2	2
CO2	1	2			1							2	2	2
CO3	1	2			1							2	2	2

COURSE CONTENT	
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

MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

(ECE)

III B. Tech I Semester

Course Category	Professional core	**Course Code**	19EC5L09
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Digital Electronics	**InternalAssessment** **Semester EndExamination** **TotalMarks**	25 50 75

COURSE OBJECTIVES	
1	Develop assembly language program using MASM
2	Understand the peripheral devices interfacing
3	Learn assembly language program using 8051

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Develop assembly level language program using MASM.	K3
CO2	Understand Interfacing of 8086 Microprocessor with peripheral devices.	K2
CO3	Develop assembly level language program using 8051	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2		2							1	2	2
CO2	1	1	3		1							2	2	3
CO3	1	1	3		2							2	3	2

List of Experiments	
PART- A: 8086 Assembly Language Programming using Assembler Directives (Minimum Seven Experiments Should Be Conducted)	
1	Sorting of an array
2	Multi byte addition/Subtraction
3	BCD & ASCII arithmetic operations
4	Factorial of given n-numbers
5	Multiplication and Division operations
6	Logic Operations: BCD To ASCII , ASCII To BCD, Packed BCD To Unpacked BCD Conversion.
7	String Operations: Transfer, Comparison, Reversal, Deletion, Insertion
8	Stack operations
PART- B: 8086 Interfacing	
1	PPI-Intel8255 Interface using 8086
2	Programmable Interruptcontroller-8259 Interface using 8086
3	D/A Interface through Intel8255
4	Keyboard and Display Interface through Intel8279
5	Elevator Interface using 8086
6	Blinking and fading of LED using Arduino and Raspberry Pi

PART- C: 8051 Assembly Language Programs	
1	Arithmetic operations using 8051
2	Ones and Two's complement of an 8-bit and 16-bit Number
3	Ascending/ Descending order
4	Setting and Masking bits in an 8-bit Number
5	Stepper Motor Interfacing Using 8051

Equipment Required:

1. Regulated Powersupplies
2. Analog/Digital StorageOscilloscopes
3. 8086 Microprocessorkits
4. 8051 microcontrollerkits
5. ADCmodule
6. DACmodule
7. Stepper motormodule
8. Keyboardmodule
9. LED,7-SegemtUnits
10. DigitalMultimeters
11. ROM/RAM Interfacemodule
12. Bread Boardetc.

DIGITAL SIGNAL PROCESSING

(ECE)

III B. Tech II Semester

Course Category	Professional Core	**Course Code**	19EC6T27
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Signals and systems	**InternalAssessment** **Semester EndExamination** **TotalMarks**	30 70 100

COURSE OBJECTIVES	
1	Analyze the discrete-time signals and systems in time and frequency domains.
2	Know the importance of FFT algorithm for computation of Discrete Fourier Transform
3	Understand the various implementations of digital filter structures
4	Learn the FIR and IIR Filter design procedures
5	Learn the concepts of DSP Processors

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Formulate engineering problems in terms of DSP operations. Analyzedigital signals and systems	K4
CO2	Analyse discrete time signals infrequency domain	K4
CO3	Design IIR digital filters and implement with different structures	K4
CO4	Design FIR digital filters and implement with different structures	K4
CO5	Understand the key architectural	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	3	-	-	-	-	-	-	-	3	3
CO2	3	3	-	-	3	-	-	-	-	-	-	-	3	3
CO3	3	2	3	-	3	-	-	-	-	-	-	-	3	3
CO4	3	2	3	-	3	-	-	-	-	-	-	-	3	3
CO5	**3**	1	-	-	-	-	-	-	-	-	-	-	2	3

COURSE CONTENT	
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 & FOURIER TRANSFORMS:** Properties ofdiscrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT)-Radix-2 decimation-in-time and decimation-in-frequency FFT Algorithms, Inverse FFT, Circular convolution and linear convolution using DFT.
UNIT III	**DESIGN OF IIR DIGITAL FILTERS & REALIZATIONS:** Analog filterapproximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposedforms.
UNIT IV	**DESIGN OF FIR DIGITAL FILTERS & REALIZATIONS:** Characteristics of FIR Digital Filters, Frequency response. Design of FIR Digital Filters using Window technique and Frequency Sampling technique, Comparison of IIR & FIR filters.Basic structures of FIR systems.
UNIT V	**INTRODUCTION TO DSP PROCESSORS:** Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs, Multiple Access Memory, Multi ported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals. **Architecture of ARM processors:** Technical details of ARM Processors, Introduction to Cortex-M3 and cortex M4 processors - Processor type, processor architecture, instruction set, block diagram, memory systems.

TEXT BOOKS	
1.	Digital Signal Processing, Principles, Algorithms, and Applications --John G. Proakis,DimitrisG.Manolakis, 4th edition, PHI, 2013.
2.	Digital Signal Processors, Architecture, Programming and Applications – B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002.
REFERENCE BOOKS	
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.
3.	Digital signal Processing --A Anand Kumar, Eastrn economy edition, PHI, 2013.
WEB RESOURCES	
1.	www.nptelvideos.in/2012/12/digital signal processing.html

VLSI DESIGN

(ECE)

III B. Tech II Semester

Course Category	Professional Core	**Course Code**	**19EC6T28**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	DIGITAL IC AAPLICATIONS	**InternalAssessment** **Semester EndExamination** **TotalMarks**	30 70 100

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 and to understand basic circuit concepts.
3	To know the basic building blocks of Analog IC design
4	To study various Combinational and sequential Logic circuit designs
5	To study the role of FPGA in VLSI design and usage of advanced technolgies

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Demonstrate a clear understanding of CMOS fabrication flow and impact of electrical properties of MOS circuits in semiconductor industry.	K2
CO2	Know three sets of design rules with which NMOS and CMOS design may be fabricated by understanding concepts of circuits and scaling of MOS devices	K4
CO3	Design the basic building blocks of Analog IC	K3
CO4	Discuss about the integrated circuit characterization and performance estimation.	K3
CO5	Understand the importance of FPGA and effect of advanced technology towards performance of VLSI design	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2								1	1	1
CO2	1	3	3	2	3							1	2	2
CO3	1	1	1	2	1							1	1	1
CO4	1	1	1	2	1							1	1	1
CO5	1	1	1	1								2	1	1

COURSE CONTENT	
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	**CIRCUIT DESIGN PROCESSES:** MOS Layers, Stick Diagrams, Design Rules and Layout, Layout Diagrams for MOS Circuits **BASIC CIRCUIT CONCEPTS:** Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, 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, Gatelogic.
UNIT III	**BASIC BUILDING BLOCKS OF ANALOG IC DESIGN:** Regions of operation of MOSFET, Modelling of transistor, body bias effect, biasing styles, single stage amplifier with resistive load, single stage amplifier with diode connected load, Common Source amplifier, Common Drain amplifier, Common Gate amplifier, current sources and sinks.
UNIT IV	**CMOS COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUIT DESIGN**: **Static CMOS Design**: Complementary CMOS, Rationed Logic, Pass-Transistor Logic. **Dynamic CMOS Design**: Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates, Choosing a Logic Style, Gate Design in the Ultra Deep- Submicron Era, Latch Versus Register, Latch based design, timing decimation, positive feedback, instability, Metastability, multiplexer based latches, Master- Slave Based Edge Triggered Register, clock to q delay, setup time, hold time, reducedclockloadmasterslaveregisters,ClockedCMOSregister.Crosscoupled NAND and NOR, SR Master Slave register, Storage mechanism, pipelining
UNIT V	**FPGA DESIGN:** FPGA design flow, Basic FPGA architecture, FPGA Technologies, Introduction to FPGAFamilies. **INTRODUCTION TO ADVANCED TECHNOLOGIES:** Giga-scale dilemma, Short channel effects, High–k, Metal Gate Technology, FinFET, TFET.

TEXT BOOKS	
1.	Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited, 2005 Edition
2.	Design of Analog CMOS Integrated Circuits by Behzad Razavi , McGraw Hill, 2003
REFERENCE BOOKS	
1.	IntroductiontoVLSICircuitsandSystems**,**JohnP.Uyemura,JohnWiley&Sons,reprint 2009
2.	Integrated Nanoelectronics: Nanoscale CMOS, Post-CMOS and AlliedNanotechnologies Vinod Kumar Khanna, Springer India, 1st edition, 2016.
3.	Digital Integrated Circuits, Jan M. Rabaey, AnanthaChandrakasan and Borivoje Nikolic,2nd Ed, 2016

MICROWAVE ENGINEERING

(ECE)

III B. Tech II Semester

Course Category	Professional Core	**Course Code**	**19EC6T29**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Electromagnetic Waves and Transmission Lines, Antenna Wave and Propagation.	**InternalAssessment** **Semester EndExamination** **TotalMarks**	30 70 100

COURSE OBJECTIVES	
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, solid state devices. Microwave solid state devices
5	Measurement of microwave parameters and fundamentals of HFSS

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Determine dominant modes and cut off frequencies of rectangular wave guides	K2
CO2	Analyze different microwave junctions and components	K3
CO3	Determine the S-matrix for microwave junctions like E-plane, H-plane and Magic Tee etc	K2
CO4	Compute power and efficiency of klystron tubes	K2
CO5	Measure microwave parameters like phase, attenuation, impedance, frequency and VSWR.and learn Basics of HFSS	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	-	3	2
CO2	3	2	1	2	-	-	-	-	-	-	-	-	1	2
CO3	3	2	1	1	-	-	1	-	-	-	-	-	1	2
CO4	3	2	1	1	-	-	1	-	-	-	-	-	2	2
CO5	2	1	1	2	-	-	-	-	-	-	-	-	1	2

COURSE CONTENT	
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. **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
UNIT IV	**REFLEX KLYSTRONS**: Structure, Applegate Diagram and Principle of working, Oscillating Modes and output Characteristics, Electronic and Mechanical Tuning, Related Problems. **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.
UNIT V	**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. Computational Mechanism tools and its overview, Perfectly Matched Layer (PML), Finite Conductivity Layered Impedance, Impedance Symmetry, Lumped RLC Master/Slave, Screening Impedance, Perfect H.

TEXT BOOKS	
1.	Microwave Devices and Circuits - Samuel Y.Liao, PHI,2009.
2.	Microwave Circuits and Passive Devices – M.L. Sisodia and G.S.Raghuvanshi, Wiley Eastern Ltd., New Age International Publishers Ltd., 1995
REFERENCE BOOKS	
1.	Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.
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 RESOURCES	
1.	http://nptel.ac.in/courses/1171051/
2.	https://onlinecourses.nptel.ac.in/noc16_ec09
3	https://elearning.ju.edu.jo/file.php/15311/HFSSintro.pdf

EMBEDDED SYSTEMS

(ECE)

III B. Tech II Semester

Course Category	**Professional Elective**	**Course Code**	19EC6T
Course Type	**Theory**	**L-T-P-C**	3-0-0-3
Prerequisites	**Microprocessors and Microcontrollers**	**InternalAssessment** **Semester EndExamination** **TotalMarks**	30 70 100

COURSE OBJECTIVES	
1	The basic concepts of an embedded system are introduced. The various elements of embedded hardware and their design principles are explained.
2	Different steps involved in the design and development of firmware for embedded systems is elaborated.
3	Internals of Real-Time operating system and the fundamentals of RTOS based embedded firmware design is discussed.
4	Fundamental issues in hardware software co-design were presented and explained. Familiarize with the different IDEs for firmware development for different family of processors/controllers and embedded operating systems.
5	Embedded system implementation and testing tools are introduced and discussed.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basic concepts of an embedded system and able to know an embedded system design approach to perform a specific function.	K2
CO2	The hardware components required for an embedded system and the design approach of an embedded hardware	K2
CO3	The various embedded firmware design approaches on embedded environment.	K2
CO4	Understand how to integrate hardware and firmware of an embedded system using real time operating system	K2
CO5	Familiarize with the different IDEs for firmware development for different family of processors/controllers and testing tools are introduced and discussed.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												1	1
CO2	3												1	1
CO3	2												1	1
CO4	2		1										1	1
CO5	**2**				1								1	1

COURSE CONTENT	
UNIT I	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, Introduction to robotics
UNIT II	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 approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus EmbeddedC and Compiler versus Cross-compiler
UNIT IV	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, Computational models in embedded design, Hardware software Trade- offs, Integration of Hardware and Firmware, ICE
UNIT V	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 andtools 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 Noergaard, Elsevier Publications, 2013
2.	Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.
REFERENCE BOOKS	
1.	Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013
2.	Embedded Systems-Lyla B.Das-Pearson Publications, 2013
3.	Embedded Systems: Architecture, Programming and Design, 2nd Edition, Raj Kamal, 2009
WEB RESOURCES	
1.	http://nptel.ac.in/courses/1171063

WIRELESS COMMUNICATIONS

(ECE)

III B. Tech II Semester

Course Category	PROFESSIONAL ELECTIVE	**Course Code**	**19EC6T32**
Course Type	THEORY	**L-T-P-C**	3-0-0-3
Prerequisites	Digital Communications	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To provide the students with the fundamental treatment about many practical and theoretical concepts that forms basic of wireless communications.
2	To prepare students to understand the concept of frequency reuse, and be able to apply it in the design of mobile cellularsystem.
3	To prepare students to understand various modulation schemes and multiple access techniques that are used in wireless communications
4	To provide an analytical perspective on the design and analysis of the traditional and emerging wireless networks, and to discuss the nature of, and solution methods to,the fundamental problems in wireless networking.
5	To train students to understand the architecture and operation of various wireless wide area networks such as GSM, IS-95, GPRS and SMS.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the principles of wireless communications and wireless networking	K2
CO2	Understand cellular system design concepts.	K2
CO3	Analyze various multiple access schemes, wireless wide area networks and their performance analysis used in wireless communication.	K4
CO4	Demonstrate wireless local area networks, equalisation and diversity.	K3
CO5	Familiar with some of the existing and emerging wireless standards.	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1									1	2
CO2	2	3	1	1									1	1
CO3	2	2	2	1									1	2
CO4	1	1	3	2									2	1
CO5	**1**	1	2	3									1	1

COURSE CONTENT	
UNIT I	**The Cellular Concept-System Design Fundamentals:** Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies- Prioritizing Handoffs, Practical Handoff Considerations, Interference and system capacity – Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference, Power Control for Reducing interference, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring.
UNIT II	**Mobile Radio Propagation: Large-Scale Path Loss** Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection- Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two- Ray) Model, Diffraction-Fresnel Zone Geometry, Knife- edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models- Longley-Ryce Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.
UNIT III	**Mobile Radio Propagation: Small –Scale Fading and Multipath** Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel- Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread, Statistical Models for multipath Fading Channels-Clarke's model for flat fading, spectral shape due to Doppler spread in Clarke's model,Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.
UNIT IV	**Equalization and Diversity:** Introduction, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non linear Equalization- Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for adaptive equalization. Diversity Techniques-Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, Practical Space Diversity Consideration-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.
UNIT V	**Wireless Networks** Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a, b, g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.

TEXT BOOKS	
1.	Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed.,2002, PHI.
2.	Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
REFERENCE BOOKS	
1.	Wireless Communication and Networking – William Stallings, 2003, PHI.
2.	Wireless Digital Communications – Kamilo Feher, 1999, PHI
3.	Principles of Wireless Networks – Kaveh PahLaven and P. Krishna Murthy, 2002, PE
WEB RESOURCES	
1.	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ee33/

Biomedical Instrumentation

(ECE)

III B. Tech II Semester

Course Category	Professional Elective	**Course Code**	19EC6T33
Course Type	Theory (Elective)	**L-T-P-C**	3-0-0-3
Prerequisites	Basic knowledge on physics, chemistry, and mathematics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To study bio electrodes, bio amplifier, and measurement of physiological parameters.
2	To study the communication mechanics in a biomedical system with few examples.
3	Analyze the function of heart.
4	To study EEG and EMG machines, recordings and interpretations.
5	To understand therapeutic and cardic instrumentation

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	The concept of biomedical instrumentation.	K2
CO2	Ability to understand the philosophy of the heart, lung, blood circulation and respiration system.	K2
CO3	Analyse ECG recordings for disorder identification	K3
CO4	Analyse EEG and EMG recordings for disorder identification	K3
CO5	Ability to understand the analysis systems of various organ types	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1										1	
CO2	2	3	1										1	
CO3	1	1	3											1
CO4		1	2	3										1
CO5		1	1	1	2								1	

COURSE CONTENT	
UNIT I	**Components of Medical Instrumentation & System:** Bio Electrodes: Bio-potential Electrodes-External electrodes, Internal Electrodes. Biochemical Electrodes. Bio-amplifier. Static and dynamic characteristics of medical instruments.
UNIT II	**Organization of cell**: Nernst equation for membrane Resting Potential Generation and Propagation of Action Potential, Conduction through nerve to neuromuscular junction. Bio-signals and characteristics. Problems encountered with measurements from human beings.

UNIT III	**Mechanical function**: Electrical Conduction system of the heart. Cardiac cycle. Relation between electrical and mechanical activities of the heart. **Cardiac Instrumentation**: Blood pressure and Blood flow measurement. Specification of ECG machine. Einthoven triangle, Standard 12-lead configurations, Interpretation of ECG waveform with respect to electro mechanical activity of the heart**.**
UNIT IV	**Neuro-Muscular Instrumentation**: Specification of EEG and EMG machines. Electrode placement for EEG and EMG recording. Interpretation of EEG and EMG.
UNIT V	**Therapeutic equipment**: Pacemaker, Defibrillator, Shortwave diathermy. Haemodialysis machine**. Respiratory Instrumentation:** Mechanism of respiration, Spirometry, Pnemuotachograph Ventilators.

TEXT BOOKS	
1.	Handbook of Biomedical Instrumentation, Khandpur R.S, Tata McGraw-Hill, New Delhi,2nd edition, 2003.
2.	Medical Instrumentation, Application and Design, John G. Webster, John Wiley.
REFERENCE BOOKS	
1.	Principles of Applied Biomedical Instrumentation, L.A. Geoddes and L.E. Baker, John Wiley
2.	Biomedical Equipment Technology, Carr& Brown, Pearson.
3.	Akay, Metin., Wiley encyclopedia of biomedical engineering, 2006
WEB RESOURCES	
1.	http://www.digimat.in/nptel/courses/video/108105101/L28.html

MULTIMEDIA AND COMMUNICATION

(ECE)

III B. Tech II Semester

Course Category	Professional Elective	**Course Code**	19EC6T34
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Communication Systems	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Gain fundamental knowledge in understanding the basics of different multimedia networks and applications.
2	Understand digitization principle techniques required to analyze different media types.
3	Analyze compression techniques required to compress text and image and gain knowledge of DMS.
4	Analyze compression techniques required to compress audio and video.
5	Gain fundamental knowledge about multimedia communication across different networks.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand basics of different multimedia networks and applications.	K2
CO2	Understand different compression techniques to compress audio and video.	K2
CO3	Describe multimedia Communication across Networks.	K3
CO4	Analyze different media types to represent them in digital form.	K4
CO5	Compress different types of text and images using different compression techniques and analyse DMS.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									1	2
CO2	2	3	1	1									1	1
CO3	2	2	3	1									1	1
CO4	1	1	2	3									1	2
CO5	**1**	2	2	2									1	1

COURSE CONTENT	
UNIT I	Multimedia Communications: Introduction, Multimedia information representation, multimedia networks, multimedia applications such as video telephony/teleconferencing, Electronic mail, interactive TV, Electronic commerce, Web TV.
UNIT II	Information Representation: Introduction, Digitization principles, Text, Images, Audio and Video, standards for multimedia communication

UNIT III	Text and image compression: Introduction, Compression principles, text compression, image Compression. Distributed multimedia systems: Introduction, main Features of a DMS, Resource management of DMS, Networking, Multimedia operatingsystems
UNIT IV	Audio and video compression: Introduction, Audio compression, video compression, video compression principles, video compression, video coding, mixed signal data transmission.
UNIT V	Digital communication basics, operation of different kinds of networks, the internet, Broadband ATM networks, Entertainment networks, high speed modems

TEXT BOOKS	
1.	Multimedia Communications, Fred Halsall, Pearson education, 2001, ISBN 9788131709948.
2.	Multimedia Communication Systems, K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, Pearson education, 2004. ISBN -9788120321458
REFERENCE BOOKS	
1.	Multimedia: Computing, Communications and Applications, Raifsteinmetz, KlaNahrstedt, Pearson education, 2002. ISBN -9788177584417
2.	Multimedia Communications and Networking Mario Marques da Silva , 2012
3.	Multimedia Communications: Applications, Networks, Protocols and Standards Halsall, 2001

DIGITAL SIGNAL PROCESSING LABORATORY

(ECE)

III B Tech II Semester

Course Category	Professional Core	**Course Code**	**19EC6L12**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Digital Signal Processing Theory	**InternalAssessment** **Semester EndExamination** **TotalMarks**	25 50 75

COURSE OBJECTIVES: To make the students familiarize with the	
1	Convolution and FFT implementation using MATLAB.
2	FIR and IIR filters using implementation MATLAB
3	The architecture details of TMS320C54XX DSP.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Implementation of convolution and FFT using MAT LAB	K3
CO2	Analyze FIR and IIR filters using MAT LAB	K4
CO3	Study the architecture of TMS320C54XX DSP and simulation of convolution, digital filters and FFT using code composer studio	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	3	-	-	-	-	-	-	-	1	1
CO2	2	2	2	-	3	-	-	-	-	-	-	-	2	1
CO3	1	2	1	-	3	-	-	-	-	-	-	-	2	1

LIST OF EXPERIMENTS:

Using MAT Lab

1. Verification of linearconvolution
2. Verification of circularconvolution.
3. To design FIR filter (Low Pass) using windowingtechnique
   a) Using rectangularwindow
   b) Using triangularwindow
4. To design FIR filter (High Pass) using windowingtechnique
   a) Using rectangularwindow
   b) Using triangularwindow
5. To Implement IIR Low passfilter
6. To Implement IIR High passfilter
7. Find the sum of DT sinusoidalsignals.
8. N-point FFT algorithm.
9. Find frequency response of analog Low Pass/High Passfilters.

Using Code Composer Studio

1. Verify the Linear Convolution of two DTsignals
2. Verify the Circular Convolution oftwo DT signals
3. Computation of Discrete Fourier Transform (DFT) and Inverse DiscreteFourier Transform (IDFT).
4. Design of IIRFilters.
5. Design of FIRFilter.
6. N-point FFT algorithm

VLSI LABORATORY

(ECE)

III B Tech II Semester

Course Category	Professional Core	**Course Code**	**19EC6L13**
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	STLD	**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 75

COURSE OBJECTIVES: To make the students familiarize with the	
1	Design of analog and digital circuits.
2	Usage of EDA tool to simulate, draw schematic and layout, analyze, and test of analog and digital circuits.
3	VHDL and Verilog Codes

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	write VHDL/Verilog code.	K2
CO2	use EDA tools to perform simulation, draw schematic and layout, analysis, testing, and interpret results..	K2
CO3	design analog and digital circuits	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	1	2	-	-	-	-	-	-	-	-	-
CO2	1	2	1	1	3	-	-	-	-	-	-	-	2	1
CO3	1	2	3	3	3	-	-	-	-	-	-	1	2	1

LIST OF EXPERIMENTS:

PART – A (Any 6 of the following experiments are to be conducted)

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

LIST OF EXPERIMENTS

1. Realization of Logic Gates
2. Design of Full Adder using 3 modelingsystems
3. 3 to 8 Decoder-74138
4. 8 to 3 Encoder (with and withoutparity)
5. 8 x 1 Multiplexer-74151 and 2x 4De-multiplexer-74155
6. 4- Bitcomparator-7485
7. DFlip-Flop-7474
8. Decade counter-7490

PART – B (Any 6 of the following experiments are to be conducted)

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 1nm Technology with necessary EDA tools (Mentor Graphics/Tanner).

List of Experiments:

1. Design and implementation of aninverter.
2. Design and implementation of universalgates.
3. Design and implementation of fulladder.
4. Design and Implementation ofDecoder.
5. Design and implementation ofD-latch.
6. Design and implementation asynchronouscounter.
7. Design and Implementation of static RAMcell.
8. Design and Implementation of ring oscillator.

EQUIPMENTS & SOFTWAREREQUIRED

1. Xilinx14.4
2. Spartan FPGAkits
3. Mentor Graphics/Tanner software-latestversion
4. Personal computer with necessaryperipherals

MICROWAVE ENGINEERING LABORATORY

(ECE)

III B Tech IISemester

Course Category	Professional Core	**Course Code**	19EC6L14
Course Type	LABORATORY	**L-T-P-C**	0-0-3-1.5
Prerequisites	Microwave Engineering Theory	**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 75

COURSE OBJECTIVES: To make the students familiarize with the	
1	Characteristics of microwave devices and circuits
2	Analyzed microwave device parameters
3	Study the characteristics of optical devices

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Measure the characteristics of microwave devices and circuits: Reflex klystron, Gunn Diode, Directional Coupler.	K3
CO2	Measure of microwave device parameters: Attenuation, VSWR, Impedance, Frequency, Waveguide, Circulator, Magic Tee.	K3
CO3	Measure the characteristics of optical devices: LED, Laser diode, NA, Losses, Data rate, Intensity Modulation.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	-	-	-	-	-	-	-	2	2
CO2	2	2	1	2	-	-	-	-	-	-	-	-	2	2
CO3	3	1	2	2	2	-	-	-	-	-	-	-	2	2

LIST OF EXPERIMENTS:

1. To verify Reflex Klystron Characteristics and to determine the frequency and tuning range of reflex klystron.
2. To verify Gunn DiodeCharacteristics.
3. To determine crystal index of the detectordiode.
4. To draw the calibration curve of theattenuator.
5. To determine the coupling factors and directivity of directionalcoupler.
6. To measure the power distribution of various wave guide Tee i.e. E plane, Hplane.
7. To measure the power distribution of various wave guide MagicTee
8. VSWR Measurement and load impedance calculations using smithchart for different conditions.
9. Scattering parameters ofCirculator.
10. To measure the radiation pattern ofantennas.
11. Characterization of Microstripcomponents.

Add on experiment: (As a mini project)

12. Design of micro stripantenna.

Equipment required for Laboratories:

1. **Regulated Klystron PowerSupply**
2. **VSWR Meter-**
3. **Micro Ammeter - 0 – 500 μA**
4. **Multi meter**
5. **CRO**
6. **GUNN Power Supply, Pin Modulator**
7. **Reflex Klystron**
8. **CrystalDiodes**
9. **Micro wave components (Attenuation)**
10. **FrequencyMeter**
11. **Slotted linecarriage**
12. **Probedetector**
13. **wave guide shorts**
14. **Pyramidal HornAntennas**
15. **DirectionalCoupler**
16. **E, H, MagicTees**
17. **Circulators,Isolator**
18. **MatchedLoads**

DATA COMMUNICATIONS & COMPUTER NETWORKS

(ECE)

IVB. Tech ISemester

Course Category	Professional Core	**Course Code**	**19EC7T36**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Communications basics	**InternalAssessment** **Semester EndExamination** **TotalMarks**	30 70 100

COURSE OBJECTIVES	
1	Understand the data communication models , terminology and architectures of the computer networks and various layers of computer networks.
2	Analyze Data link layer protocols using error detection codes
3	Understand Network layer routing mechanisms
4	Understand Internetwork layer protocols
5	Analyze Transport layer and application layer protocols

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		
CO1	Conceptualize the data communication models using OSI/ISO and TCP/IP protocol architectures.	Evaluate
CO2	Analyze protocols implemented in data link layer for error and flow control. Analyze the features and operations of different MAC mechanisms.	Analyze
CO3	Build the skills of subnetting and routing mechanisms	Apply
CO4	Choose network protocols by elucidate the way protocols currently in use in the Internet like IPv4, IPv6, ICMP, ARP, RARP, DHCP operate	Apply
CO5	Develop client/server based applications using TCP and UDP protocols	Apply

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									1	2
CO2	2	3	1	1									1	1
CO3	2	2	3	1									1	1
CO4	1	1	2	3									1	2
CO5	**1**	2	2	2									1	1

COURSE CONTENT	
UNIT I	**INTRODUCTION TO DATA COMMUNICATIONS AND NETWORKING**: Standards Organizations for Data Communications, Protocol, Layering Scenario, 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 COMMUNICATIONSCODES, ERRORCONTROL, AND DATA LINKLAYER-**designissues,ErrorDetectionanderrorcorrectioncodes,CRC codes, Elementary Data Link Layer Protocols, Flow control -sliding window protocols: stop-and-wait ARQ, Go-back-n ARQ, Selective Repeat ARQ, HDLC

	MULTI LAYER 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 III	**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, Datagram for audio and video calls.
UNIT IV	**INTERNETWORKING:** Tunneling, Internetwork Routing, Packet fragmentation, IPv4, introduction to IPv6 Protocol, IP addresses, ICMP, ARP, RARP, DHCP, Voice Over IP, Network Security basics and QR Codes.
UNIT V	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.	An Engineering Approach to Computer Networks -S.Keshav, Pearson Education,2nd Edition,1997.
2.	Data Communications and Networking - Behrouz A.Forouzan, Fifth Edition TMH, 2013
REFERENCE BOOKS	
1.	Understanding communications and Networks, W. A. Shay, Cengage Learning,3rd Edition, 2004
2.	Computer Networks - Andrew S Tanenbaum, Pearson Education, 4th Edition 2003
3.	Data Communications and Computer Networks, Prakash C. Gupta, PHI, 2nd edition, 2013
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 AND VIDEO PROCESSING
(ECE)
IV. Tech I Semester

Course Category	Professional Core	**Course Code**	19EC7T37
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Fourier transform of signals and sampling process	**InternalAssessment** **Semester EndExamination** **TotalMarks**	30 70 100

COURSE OBJECTIVES	
1	Learn basic concepts of digital image processing and image transforms.
2	Familiarize with image enhancement methods like transformations, filtering methods and restoration techniques.
3	Learn various image compression models and image segmentation fundamentals.
4	Learn analog and digital video basics and various image formation models.
5	Understand different motion estimation methods.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Know the fundamentals in image processing and transform techniques.	K2
CO2	Implement filtering operations for image enhancement, and can restore the image.	K2
CO3	Interpret the image compression techniques and can implement image segmentation processes.	K4
CO4	Know the concepts of color image, analog and digital Video processing and image Formation models.	K3
CO5	Interpret motion estimation by using various algorithms like pixel based and block matching algorithms.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	-	1	2	-	-	-	-	-	1	1	1
CO2	2	2	1	-	2	2	-	-	-	-	-	-	2	-
CO3	3	1	1	2	1	1	-	-	-	-	-	-	1	1
CO4	3	2	2	1	1	1	-	-	-	-	-	-	1	1
CO5	2	1	1	2	1	1	-	-	-	-	-	-	1	2

COURSE CONTENT	
UNIT I	**Fundamentals of image processing:** 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 basicrelationships between pixels

	Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of One variable andtwovariables. Properties of the 2-D Discrete Fourier transform, Discrete Cosinetransform.
UNIT II	**Image Enhancement and Restoration:** Background, some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters. The basics of filtering in the frequency domain, image smoothing and sharpening. A model of the image degradation / restoration process, noise models, restoration in the presence of noise –only spatial filtering, estimating the degradation function, inverse filtering, minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter. .
UNIT III	**Image Compression and Segmentation:** Fundamentals, Basic compression methods-Huffman coding, bit-plane coding, block transform coding, Predictive coding. Fundamentals in image segmentation- point, line, edge detection, thresholding, and region based segmentation.
UNIT IV	**Basics Video Processing:** Basics of color image processing, Analog video, Digital Video, Time varying Image Formation models, 3-D motion models, Geometric Image formation, Photometric Image formation, video processing and their protocols.
UNIT V	**Motion Estimation:** Optical flow, general methodologies, pixel-based motion estimation and its protocols, Block matching algorithm, mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation.

TEXT BOOKS	
1.	Digital Image Processing --R. C. Gonzalez and R. E. Woods, 3rdedition, Prentice Hall of India, 2008.
2.	Video processing and communication, Yao wang, JoemOstarmann and Ya – quin Zhang, 1stedition , PHI.
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.	M. Tekalp ,‖Digital video Processing‖, Prentice Hall International
WEB RESOURCES	
1.	https://onlinecourses.nptel.ac.in/noc16_ec14/

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(ECE)

IV B Tech I Semester

Course Category	Professional core	**Course Code**	**19EC7T38**
Course Type	THEORY	**L-T-P-C**	3-0-0-3
Prerequisites	Electronic devices and Circuits, Linear IC Applications	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

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 analysers 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 and Measuring physical parameters using transducers

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Identify the instrument for specific measurements and also understand, estimate errors in measurements	K2
CO2	Acquire the knowledge on signal generators and wave analyzers for communication applications	K2
CO3	Understand the operation of different oscilloscopes	K2
CO4	Estimate the values of R, L, C and frequency employing suitable bridges	K2
CO5	Know the basic principles of transducers, Measure the physical parameters and to Identify data acquisition system for a specific application	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	-	3	2
CO2	2	2	1	2	1	-	-	-	-	-	-	-	1	2
CO3	3	2	1	2	2	-	-	-	-	-	-	-	1	2
CO4	2	2	1	2	2	-	-	-	-	-	-	-	2	2
CO5	2	1	2	3	3	-	-	-	-	-	-	-	1	2

COURSE CONTENT	
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. Overview of DC Voltmeters, AC voltmeters **MEASUREMENT OF PHYSICAL PARAMETERS:** Strain, Load, Force, Pressure, Velocity, humidity, moisture, speed, proximity and displacement, Data acquisition systems, Multimeters.

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 methodoffrequencymeasurement,standardspecificationsofoscilloscopes,probesfor oscilloscopes- Active and Passive, attenuator type.
UNIT IV	**AC BRIDGES:** Q-meter, Measurement of inductance- Maxwell's bridge, Anderson bridge. Measurement of capacitance -Schearing Bridge. Wheatstone bridge, Wien Bridge, Errors and precautions in using bridges.
UNIT V	**TRANSDUCERS**: Active and passive transducers - Resistance, Capacitance, Inductance, Strain gauges, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors, Sensor Networking, Introduction to signal concentration, overview of Data Acquisition System, Transducers on signal conditioning.

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
REFERENCE BOOKS	
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 RESOURCES	
1.	www.nptel.ac.in/courses/108105064

CPLD AND FPGA ARCHITECTURE

(ECE)

IV B. Tech I Semester

Course Category	Professional Elective	**Course Code**	19EC7T40
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Digital IC Applications	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
The student will:	
1	Study the architectures of different PLDs
2	Study different architectures of FPGA Programming technologies
3	Understand programming technologies of SRAM Programmable FPGAs
4	Study different Anti Fuse Programming technologies
5	Case study on different design issues and architectures of CPLD and FPGA

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	understand various architectures and device technologies of PLD's	K2
CO2	discuss the architectures and applications of FPGA Programming Technologies	K2
CO3	understand various architectures and programming technologies of SRAM Programmable FPGAs	K2
CO4	Discuss various architectures and programming technologies ofAnti-Fuse Programmed FPGAs	K2
CO5	design examples of various CPLD and FPGA Architectures and to discuss the General Design Issues	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	1	0	0	0	0	0	0	0	0	0	0	0
CO2	3	2	2	2	2	0	0	0	0	0	0	0	2	0
CO3	3	2	2	2	2	0	0	0	0	0	0	0	2	0
CO4	3	2	2	2	2	0	0	0	0	0	0	0	2	0
CO5	**3**	3	3	3	3	0	0	0	0	0	0	0	3	0

COURSE CONTENT	
UNIT I	Introduction to Programmable Logic Devices Introduction, Simple Programmable Logic Devices – Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Programmable Logic Devices/ Generic Array Logic; Complex Programmable Logic Devices

	– Architecture of Xilinx Cool Runner XCR64XL CPLD, CPLD Implementation of a Parallel Adder with Accumulation**.**
UNIT II	Field Programmable Gate Arrays Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications, Merits, Demerits and limitations of FPGAs.
UNIT III	SRAM Programmable FPGAs Introduction, Programming Technology, Device Architecture, The Xilinx XC2000, XC00 and XC4000 Architectures, Power Analysis-Static and dynamic.
UNIT IV	Anti-Fuse Programmed FPGAs Introduction, ProgrammingTechnology, Device Architecture, The Actel ACT1, ACT2 and ACT3 Architectures
UNIT V	A case Study: A Fast Video Controller, A Position Tracker for a Robot Manipulator, A Fast DMA Controller, Designing Counters with ACT devices, Designing Adders and Accumulators with the ACT Architecture, Threats and limitations of high-speed devices.

TEXT BOOKS	
1.	Field Programmable Gate Array Technology - Stephen M. Trimberger, Springer International Edition,1994.
2.	Digital Systems Design - Charles H. Roth Jr, Lizy Kurian John,2nd Ed., Cengage Learning,1998.
REFERENCE BOOKS	
1.	Field Programmable Gate Arrays - John V. Oldfield, Richard C. Dorf, Wiley India,1995.
2.	Digital Design Using Field Programmable Gate Arrays - Pak K. Chan/ Samiha Mourad, Pearson Low Price Edition,1994.
3.	FPGA based System Design - Wayne Wolf, Prentice Hall Modern Semiconductor Design Series,2004.
Web Resources	
1	https://nptel.ac.in/courses/117108040/35

WIRELESS SENSORS AND ACTUATOR NETWORKS

(ECE)

IV B. Tech I Semester

Course Category	Professional Elective	**Course Code**	19EC7T41
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Computer networks, Digital communication	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Basics of WSN and Node architecture
2	Different Networking technologies
3	Various MAC and Routing Protocols for WSN
4	Classification of Transport layer protocols
5	The security in Ad Hoc wireless networks and applications of WSN.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the common wireless sensor node architectures and fundamental concepts of WSN	Understand
CO2	Understand the various topologies of network	Understand
CO3	Analyze the MAC protocols and routing protocols in WSN.	Analyze
CO4	Analyze the transport layer protocol & security protocols	Analyze
CO5	Apply real time applications of WSN and security issues	Apply

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2		1								2	
CO2	1	3												
CO3			2										2	
CO4	1		2	1									1	
CO5			3	2								2	2	

COURSE CONTENT	
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. **APPLICATIONS of WSN:**Ultra wide band radio communication Wireless fidelity systems Future directions, Home automation.
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 WSN:** 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. **ROUTING PROTOCOLS FOR WSN:** Issues in Designing a Routing Protocol for Ad Hoc Wireless networks, Classification of routing Protocols, Table –Driven Routing Protocols, Energy aware Routing protocols.
UNIT IV	**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 V	**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. Challenges in node localization of WSN. **SENSOR NETWORK PLATFORMS AND TOOLS:** Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State centric programming. Tiny OS concept. **ACTUATORS:** Introduction to wireless sensor actuator networks, Different methods used for sensor placement and deployment.

TEXT BOOKS	
1.	Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, PHI, 2004.
2.	Wireless Sensor and Actuator Networks Algorithms and Protocols for Scalable Coordination and Data Communication, Edited by Amiya Nayak and Ivan Stojmenovic A JOHN WILEY & SONS, INC., PUBLICATION,2010.
REFERENCE BOOKS	
1.	Wireless Sensor Networks- Technology, Protocols, and, Applications - Kazem Sohraby, Daniel Minoli, and TaiebZnati, , John Wiley,2007.
2.	Wireless Sensor Networks- An Information processing Approach-Feng Zhao and LeonidasJ. Guibas, , Elsevier,2007.
3.	Ad- Hoc Mobile Wireless Networks: Protocols and Systems- C.K. Toh ,1st edition, Pearson education.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/106105160/21
2	https://www.slideshare.net/pavankumar815/unit-1-introduction-to-computer-networks
3	https://nptel.ac.in/courses/106105160/24

Digital Signal Processors & Architecture

(ECE)

IV B. Tech I Semester

Course Category	Professional Elective	**Course Code**	19EC7T42
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Signals and systems, Digital signal processing, Digital communication	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Fundamentals of DSP and fixed and floating point architectures of various DSPs
2	Architectures for Programmable DSP Devices
3	Infer about the control instructions, interrupts, and pipeline operations of TMS320C54XX Processors
4	Analog Devices Family of DSP Devices and Black fin Processor
5	Interfacing Memory and I/O Peripherals to Programmable DSP Devices

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the fundamentals and Computational Accuracy in DSP	Understand
CO2	Understand the Architectures and features of Programmable DSP Devices	Understand
CO3	Analyze the Programmable Digital Signal Processors	Analyze
CO4	Analyze the Analog Devices Family of DSP Devices and Black fin Processor	Analyze
CO5	Analyze the Interfacing Memory and I/O Peripherals to Programmable DSP Devices	Analyze

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	-	-	-	-	-	-	-	2	2
CO2	1	1	2		-	-	-	-	-	-	-	-	1	-
CO3	1	2	1	1	-	-	-	-	-	-	-	-	2	1
CO4	-	1	2	1	-	-	-	-	-	-	-	-	1	1
CO5	-	1		2	-	-	-	-	-	-	-	-	1	1

COURSE CONTENT	
UNIT I	**Review of Digital Signal Processing**: Introduction to a Digital signal processing system, the sampling process, discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time invariant systems, Digital filters, Decimation and interpolation. **Computational Accuracy in DSP Implementations:** Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors. Compensating filter.

UNIT II	**Architectures for Programmable DSP Devices**: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing.
UNIT III	**Programmable Digital Signal Processors**: Commercial Digital signal processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX Instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54XXProcessors.
UNIT IV	**Analog Devices Family of DSP Devices**: Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor. **Black fin Processor**: Introduction to Black fin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals.
UNIT V	**Interfacing Memory and I/O Peripherals to Programmable DSP Devices** : Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP)

TEXT BOOKS	
1.	Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2.	A Practical Approach To Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009.
REFERENCE BOOKS	
1.	Digital Signal Processors, Architecture, Programming and ApplicationsB. Venkataramani and M. Bhaskar, 2002, TMH.
2.	DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co
3.	Embedded Signal Processing with the Micro Signal Architecture: Woon-Seng Gan, Sen M. Kuo, Wiley-IEEE Press, 2007.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/117/102/117102060/
2	http://nptel.vtu.ac.in/econtent/courses/ECE/06EC74/

OPTICAL COMMUNICATIONS

(ECE)

IV B. Tech I Semester

Course Category	Professional elective	**Course Code**	**19EC7T43**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Communication Systems Basics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand the functionality of each of the fiber optic communication system components, and principles of single and multi-mode optical fibers characteristics
2	To understand the optical fiber properties of that affect the performance of a communication link and types of fiber materials with their properties and the losses occur in fibers.
3	To understand the working principle of optical sources and detectors
4	To understand the various methods of source to fiber power launching.
5	To understand the optical links for optical communication system

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	To Understand necessary components required in modern optical communications systems, Use different types optical fiber components	K2
CO2	To Calculate Power loss based on dispersions and distortions,	K2
CO3	To Analyze the characteristics of various optical sources and detectors.	K3
CO4	To understand optical networks with the help of optical topology..	K2
CO5	To Analyze optical links for analog and digital communication systems	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1							1			1	
CO2	2	1	1							1				
CO3	2	1	1							1				1
CO4	2	1	3							1			1	
CO5	3	2	1							1				2

COURSE CONTENT	
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. **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 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 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, Noise in detection process, Related problems.
UNIT IV	**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, Opticalreceiver operation- Fundamental receiver operation, Digital signal transmission, error sources. High performance Optical receivers
UNIT V	**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,Introduction to Free –space Optical Communication (FSO).

TEXT BOOKS	
1.	Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.
2.	Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
REFERENCE BOOKS	
1.	Fiber Optic Communications Fundamentals and Applications—shivakumar,M.Jamal Deen, wiley,2014
2.	Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Edition, 2004
3.	Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education,2005.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/115/107/115107122/
2.	https://www.coursera.org/specializations/optical-engineering
3	https://www.youtube.com/watch?v=-ap00IUJm7k

DIGITAL IMAGE PROCESSING LABORATORY (ECE)

IV Year I Semester

Course Category	Professional Core	**Course Code**	19EC7L15
Course Type	LABORATORY	**L-T-P-C**	0-0-3-1.5
Prerequisites	Digital Image Processing Theory	**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 75

COURSE OBJECTIVES	
1	Learn basic operations on digital images
2	Learn filtering operations on images.
3	Analysis of images using DFT and different color models

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Perform basic operations on digital images- arithmetic, logical and morphological operations	K2
CO2	Perform filtering operations for-image smoothing, sharpening, and image Restoration	K3
CO3	Analyze binary images by DFT and color images with various color models	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	-	3	-	-	-	-	-	-	1	1	1
CO2	2	2	2	-	3	-	-	-	-	-	-	-	2	2
CO3	3	2	2	-	3	-	-	-	-	-	-	-	1	1

LIST OF EXPERIMENTS:

1. Perform arithmetic and logical operations betweenimages.
2. Image sampling andquantization.
3. DFT analysis ofimages
4. Perform Basic operations on image (shrinking, zooming andcropping)
5. Implementsmoothingandsharpeningofimageusinglowpassandhighpassfilter.
6. Perform image restoration using spacialfilters.
7. Implement edge, line detection usingoperators.
8. Implement image compression by using bit planecoding.
9. Implement image compression by using discrete cosinetransform.
10. Perform morphological operations on image (dilation,erosion).
11. Perform opening and closing operations onimage.
12. Analysis of images with different colormodels.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION LABORATORY

(ECE)

IV Year I Semester

Course Category	Professional Core	**Course Code**	19EC7L16
Course Type	LABORATORY	**L-T-P-C**	0-0-3-1.5
Prerequisites	Electronics Measurements and Instrumentation Theory	**Internal Assessment** **Semester End Examination** **Total Marks**	25 50 75

COURSE OBJECTIVES	
1	Learn construction of oscilloscope, multimeters and frequency counters.
2	Measurement of temperature, strain and % distortion
3	Develop signal conditioning, pressure measurement.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Perform basic measurement and study on oscilloscopes, multimeters and frequency counters	K2
CO2	Analyze measurement of temperature, strain, Q of a coil and % distortion of LCR and oscillator	K4
CO3	Analyze measurement of signal conditioning, pressure measurement, distance measurement using transducers.	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	-	2	-	-	-	-	-	-	1	1	2
CO2	2	2	2	-	2	-	-	-	-	-	-	2	2	2
CO3	3	2	2	-	2	-	-	-	-	-	-	1	1	2

<u>List of Experiments:</u>

1. To study block wise construction of an analog oscilloscope & functiongenerator.
2. To study block wise construction of a multimeter & frequencycounter.
3. To study measurement of different components and parameters like Q of a coil using LCR Q-meter.
4. To study distortion factor meter and determination of % distortion of the given oscillator.
5. To study and use of thermocouple for temperature measurement.
6. Development of signal condition circuit and interfacing toread.
7. Measurement of strain using straingauge.
8. To study differential pressure transducer & signal conditioning of outputsignal.
9. Measurement of level using capacitivetransducer.
10. Study of distance measurement using ultrasonictransducer.
11. Pressure Measurement andrecording.

Analog IC Design

(ECE)

IV B. Tech II Semester

Course Category	Professional Elective	**Course Code**	**19EC8T44**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Digital IC Applications	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

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	Construct Comparator circuits improving the Performance of Open-Loop Comparators.
5	Design comparators and PLL's.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Apply the concepts of MOS Devices and Modeling involved in IC circuits	K3
CO2	Summarize the MOS sub circuits used in CMOS analog circuit design	K2
CO3	Design and Analyze amplifiers and operational amplifiers using CMOS technology used in Analog electronics	K4
CO4	Analyze the Comparators in terms of performance to measure and digitize analog signals	K3
CO5	Design Oscillators and PLL'S which has extensive applications in communication systems	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO3	2	1	1	-	-	-	-	-	-	-	-	-	2	-
CO4	1	-	1	1	-	-	-	-	-	-	-	-	1	-
CO5	1	2	-	-	-	-	-	-	-	-	-	-	2	1

COURSE CONTENT	
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 BetaHelper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.
UNIT III	**CMOS AMPLIFIERS:** Differential Amplifiers, Cascode Amplifiers, Current Amplifiers and High Gain AmplifiersArchitectures. **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.
UNIT IV	**COMPARATORS:** Characterization of Comparator, Two-Stage, Open-Loop Comparators,OtherOpen-LoopComparators,ImprovingthePerformanceofOpen-Loop Comparators, Discrete- Time Comparators.
UNIT V	**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.
REFERENCE BOOKS	
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
3.	Analog Integrated Circuit Design Tony Chan Carusone, David Johns, Kenneth William Martin · 2012

SYSTEM DESIGN THROUGH VERILOG

(ECE)

IV B. Tech II Semester

Course Category	Professional Elective	**Course Code**	19EC8T45
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Digital System Design,	**InternalAssessment** **Semester EndExamination** **TotalMarks**	30 70 100

COURSE OBJECTIVES	
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 behavioural level.
4	To understand continuous assignment structures, delays in data flow level and bidirectional gates and time delays with switch primitives.
5	To understand and study synthesis of combinational logic and sequential logic circuits and apply them to design complex real time digital systems.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand concepts of verilog HDL for designing of digital circuits	K2
CO2	Design low level modules as a primitive gate for higher level abstraction like RTL	K3
CO3	Design digital logic circuits with the use of flow charts, algorithms and truth tables by understanding concepts of sequential and concurrent statements	K3
CO4	Model the data flow level circuits and write switch level circuits	K3
CO5	Analyse the sequential and combinational circuits	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	-	-	-	1	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-	1	-
CO3	-	-	2	-	-	-	-	-	-	-	-	-	1	-
CO4	1	1	-	-	-	-	-	-	-	-	-	-	1	-
CO5	1	1	2	-	-	-	-	-	-	-	-	-	1	1

COURSE CONTENT	
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 elseconstructs,assign-Deassignconstruct,repeatconstruct,FORloop,thedisable 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 withswitchprimitives,instantiationswithstrengthsanddelays,strengthcontention with triregnets.
UNIT V	**SYNTHESIS OF COMBINATIONAL ANDSEQUENTIAL 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. 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. **VERILOG MODELS:** Static RAM Memory, 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 ZvonkoVranesic, TMH,2005.
2.	A Verilog Primier – J. Bhasker, BSP,2003.
REFERENCE BOOKS	
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
3.	Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA - Sunggu Lee, Cengage Learning, 2012.
WEB RESOURCES	
1.	http://booksnu.info/dl.php?file=digital%20systems%20design%20using%20verilog
2.	https://onlinelibrary.wiley.com/doi/book/10.1002/04717202

SATELLITE COMMUNICATION

(ECE)

IV B. Tech II Semester

Course Category	Professional elective	**Course Code**	**19EC8T46**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Digital Communications	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand the basic concepts, applications, frequencies used in satellite communications
2	To know the various satellite subsystems and its functionality.
3	To understand the concepts of satellite link design and calculation of C/N ratio. and to understand the concepts of the transmitters, receivers, antennas, tracking systems of satellite
4	To understand the concepts of multiple access and various types of multipleaccess techniques in satellite systems
5	To know the concepts of satellite navigation, architecture and applications of GPS.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	To Understand the basic principles of satellite systems.	K2
CO2	To Analyze Satellite subsystems.	K2
CO3	To Design the link budget of a satellite for specified C/N ratios. Know the concepts of satellite earth station technologies	K3
CO4	To understand Configure the satellite multiple access techniques.	K2
CO5	To develop the satellite navigation and GPS	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1							1			1	
CO2	2	1	1							1				
CO3	2	1	1							1				1
CO4	2	1	3							1			1	
CO5	3	2	1							1				2

COURSE CONTENT	
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 systemsperformance.

UNIT II	**SATELLITE SUBSYSTEMS:** Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Spacequalification
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 designexample. **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 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 transmissionand reception, PN Sequence, Direct Sequence and Frequency Hopped Spread Spectrum System.
UNIT V	**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, DifferentialGPS.

TEXT BOOKS	
1.	Satellite Communications Engineering – Wilbur L.Pritchard, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications, 2003.
2.	Satellite communication -- Pratt and Bostian, John Wiley and Sons, 2007
REFERENCE BOOKS	
1.	Satellite Communications : Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.
2.	Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004
3.	Satellite Communication - D.C Agarwal, Khanna Publications, 5th Edition.2004
WEB RESOURCES	
1.	https://nptel.ac.in/courses/117/105/117105131/

SPEECH PROCESSING

(ECE)

IV B. Tech II Semester

Course Category	Professional Elective	**Course Code**	19EC8T47
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	SS,RVSP,DSP	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Learn the concepts of speech production mechanism.
2	Know the importance of short time Fourier Transform in the analysis of speech.
3	Understand the concept of linear predictive coefficients in the analysis of speech.
4	Know the concept of spectrum in the analysis of speech.
5	Learn the concepts of Speech Enhancement and recognition

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand speech production system and describe the fundamentals of speech.	K2
CO2	Analyze different speech parameters.	K4
CO3	Understand the concept of LPC	K2
CO4	Understand the concept of spectrum analysis	K2
CO5	Design a speech enhancement, recognition system.	K6

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	2	-	3	-	-	-	-	-	-	-	2	2
CO3	3	2	2	-	3	-	-	-	-	-	-	-	3	3
CO4	3	2	2	-	3	-	-	-	-	-	-	-	3	3
CO5	**3**	3	-	-	3	-	-	-	-	-	-	-	3	3

COURSE CONTENT	
UNIT I	**Fundamentals of Digital Speech Processing:** Anatomy & Physiology of Speech Organs, The process of Speech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of Speech Production- Uniform lossless tube model, effect of losses in vocal tract, effect of radiation at lips, Digital models for speech signals.
UNIT II	**Time Domain Models for Speech Processing**: Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate, Speech Vs Silence discrimination using energy and zero crossing, Pitch period estimation using a parallel processing approach, The short timeautocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT III	**Linear Predictive Coding (LPC) Analysis:** Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations,
UNIT IV	**Homomorphic Speech Processing:**Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations,The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The HomomorphicVocoder.
UNIT V	**Speech Enhancement:** Nature of interfering sounds, Speech enhancement techniques: Single Microphone Approach : spectral subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter, Multi microphone Approach **SpeechRecognition** Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system ,Applications and present status.

TEXT BOOKS	
1.	L.R. Rabinerand S. W. Schafer, –Digital Processingof Speech Signals‖,Pearson Education.
2.	DouglasO'Shaughnessy,–Speech Communications: Human &Machine‖,2nd Ed., Wiley India, 2000
REFERENCE BOOKS	
1.	Ben Goldand Nelson Morgan, –Speech and Audio Signal Processing, Processing and Perception of Speech and Music‖, Wiley- India Edition, 2006.
2.	Benesty Jacob, M. Mohan Sondhi, and Yiteng Huang, *Handbook of speech processing*, Springer , 2007
3.	ThomasF. Quateri, –Discrete TimeSpeech Signal Processing: Principlesand Practice‖, 1st Edition., PE.
WEB RESOURCES	
1.	https://www.youtube.com/watch?v=CvpaolyseNE

RADAR ENGINEERING

(ECE)

IV B. Tech II Semester

Course Category	Professional Elective	**Course Code**	**19EC8T48**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
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, different tracking techniques for radar
4	The characteristics of a matched filter receiver and its performance.
5	Different types of displays, duplexers and antennas used in radar systems.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Familiarize the fundamentals of basic radar.	K2
CO2	Doppler Effect to detect moving targets.	K1
CO3	Analyze the MTI radar performance and radar tracking methods.	K4
CO4	Apply the concepts of matched filter and ambiguity functions in detection of radar signals in noise.	K4
CO5	Design radar receiver based on characteristics of duplexer and antennas	K1

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	1	-	1	-	-	-	-	-	1		
CO2	2	3	2	1	-	2	-	-	-	-	-	1		
CO3	2	3	2	1	-	2	-	-	-	-	-	1		
CO4	2	3	2	1	-	-	-	-	-	-	-	1		
CO5	2	3	2	1	-	3	-	-	-	-	-	1		

COURSE CONTENT	
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

UNITII	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 Diagramand Characteristics, FM-CW altimeter, Multiple Frequency CW Radar
UNITIII	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. 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, Comparisonof Trackers.
UNITIV	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.
UNITV	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.
REFERENCE BOOKS	
1.	Radar Engineering and Fundamentals of Navigational Aids -G S N Raju, IK International Publishers, 2008.
2.	Microwave and Radar Engineering, G.SasiBhushana Rao, , Pearson education, 2013
3.	Fundamental of Microwave & Radar Engineering By K. K. Sharma · 2011
WEB RESOURCES	
1.	https://nptel.ac.in/courses/108/105/108105154/

CMOS DIGITAL IC DESIGN

(ECE)

IV B. Tech II Semester

Course Category	Professional Elective	**Course Code**	**19EC8T49**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Basic knowledge in VLSI and Mos transistors concepts	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand the basic concepts of NMOS logic and inverter devices used in portable consumer devices
2	To Understand the concepts of transmission gated used to implement analog switches and multiplexers
3	To understand MOS logic and concept of flip flops for sequential circuits used temporary storage of data or delay signals
4	To introduce dynamic logic circuits used in temporary storage of signal using various load capacitances
5	Comparison of memory devices and operations

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Remember the basic concepts of NMOS logic and inverter devices used in portable consumer devices	K3
CO2	Understand the concepts of transmission gated used to implement analog switches and multiplexers	K2
CO3	Apply the MOS logic and concept of flip flops for sequential circuits used temporary storage of data or delay signals	K3
CO4	Analyze dynamic logic circuits used in temporary storage of signal using various load capacitances	K3
CO5	Compare different type of memory devices used for storage	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	2							1	1	2
CO2	1	1	3	1	2							2	1	2
CO3	1	2	3	2	2							1	1	2
CO4	2	2	2	1	2							2	1	2
CO5	1	2	3	1	1							1	1	2

COURSE CONTENT	
UNIT I	MOS Design Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output highvoltage,OutputLowvoltage,Gainatgatethresholdvoltage,Transientresponse, Risetime,Falltime,PseudoNMOSlogicgates,Transistorequivalency,CMOS Inverter logic**.**
UNIT II	Combinational MOS Logic Circuits: MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & 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.
UNIT III	Sequential MOS Logic Circuits Behaviour 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, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.
UNIT V	Semiconductor Memories 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 Circuit Design – Ken Martin, Oxford University Press, 2011.
2.	CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011.
REFERENCE BOOKS	
1.	Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2.	Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, AnanthaChandrakasan, Borivoje Nikolic, 2nd Ed., PHI
3.	CMOS VLSI Design A Circuits and Systems Perspective By Weste, Neil H. E. Weste · 2006

4G MOBILE BROADBAND AND SMALL CELL NETWORKS

(ECE)

IV B. Tech II Semester

Course Category	Professional Elective	**Course Code**	**19EC8T50**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Antennas and Propagation	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
The student will:	
1	Study Cellular communication fundamentals
2	Study the structure of GSM, antennas and cellular coverage
3	Study types of Handoff and dropped call rate
4	Study evolution of GSM technology
5	Study small cell structure

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand Cellular fundamentals	K2
CO2	Illustrate GSM structure, Antennas for cellular coverage	K2
CO3	Classify Handoff- types and outline dropped call rate	K2
CO4	Compare GSM evolutions	K2
CO5	Interpret small cell structure	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

COURSE CONTENT	
UNIT I	**Introduction to Cellular Systems:** Evolution of 4G, Spectrum efficiency considerations, Basic Cellular systems, Performance Criteria, Uniqueness of Mobile Radio environment, operation of cellular systems, Co-channel interference reduction factor, Desired C/I (Analytic Solution), Handoff mechanism, Cell Splitting-Types, Human body interactions and specific absorption rate

UNIT II	**GSM**-Overview, Architecture, Layer Modeling, Transmission, Channels and Modes, Channel coding and Interleaving, Cell Antennas and coverage: general introduction, Point-to-Point(Lee Model), Propagation over water/ flat open area, Foliage loss, Propagation: Near-in and Long distance; Antennas at Cell site
UNIT III	**Handoff**: types, purpose, algorithms, Delay hand off, Forced, MAHO, Intersystemhandoff **Dropped Call rate**: Definition, Consideration, General formula, Commonly used formula; Cell-splitting: Transmitted power, Technique
UNIT IV	Perspective systems of 4G, Different Proposed systems, CCK, Turbo codes, LDPC, 60-GHz cellular system
UNIT V	Small Cells (Micro cells), Concept, Advantages, low density small market design, Picocell zone concept. Small Cell Networks: Overview, Self-organization, Backhauling, Handover, Interference

TEXT BOOKS	
1.	WIRELESS AND CELLULAR TELECOMMUNICATIONS- William C. Y. Lee- McGraw Hill, 3E, 2006
2.	Small Cell Networks: Deployment, PHY Techniques, and Resource Management, Tony Q. S. Quek, G.D.L Roche, Ismail Guvenc, MariosKountouris- Cambridge University Press, 2013
REFERENCE BOOKS	
1.	Mobile Cellular Communication- G. Sasibhushana Rao-Pearson, 2013
2.	Small Cell Networks Deployment, Management, and Optimization - Holger Claussen, David Lopez-Perez, Lester Ho, RouzbehRazavi, Stepan Kucera –Wiley,2017
3.	LTE Small Cell Optimization-Antti Toskala, HarriHolma, Jussi Reunanen-Wiley,2016
WEB RESOURCES	
1.	https://www.nokia.com/networks/portfolio/small-cells-and-femtocells/#overview
2.	https://www.qualcomm.com/media/documents/files/small-cells-and-ultrason-presentation.pdf

EMBEDDED NETWORKING

(ECE)

IV B. Tech II Semester

Course Category	Professional Elective	**Course Code**	**19EC8T51**
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Embedded Systems	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Understand Embedded Communication Protocols
2	Understand USB and CAN Bus for microcontroller interface
3	Apply Network principles for Ethernet
4	Analyze Embedded Ethernet using UDP & TCP
5	Apply Network protocols for Wireless Embedded Networking

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand various communication protocols and port programming	Understand
CO2	Compute program to interface PIC microcontroller and CAN bus and USB	Understand
CO3	Build a network using Ethernet cables and controllers	Apply
CO4	Analyze Serving web pages that respond to user Input and Keeping Devices and Network secure	Analyze
CO5	Apply MAC protocols and topologies using wireless sensor networks	Apply

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	2	1	2	1	2	-	-	-	-	-	-	2	2
CO2	2	1	2	1	2	2	-	-	-	-	-	-	2	2
CO3	2	2	1	3	1	1	-	-	-	-	-	-	2	2
CO4	2	2	2	1	1	1	-	-	-	-	-	-	2	2
CO5	1	2	1	2	2	1	-	-	-	-	-	-	2	2

COURSE CONTENT	
UNIT I	**Embedded Communication Protocols:** Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel port programming - ISA/PCI Bus protocols – Fire wire.
UNIT II	**USB and CAN Bus:** USB bus-Introduction – Speed Identification on the bus – USB States – USB bus communication: Packets –Data flow types –Enumeration – Descriptors –PIC 18 Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames –Bit stuffing –Types of errors –Nominal Bit Timing – PIC microcontroller CAN Interface –A simple application with CAN.

UNIT III	**Ethernet Basics:** Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components – Ethernet Controllers – Using the internet in local and internet communications – Inside the Internet protocol.
UNIT IV	**Embedded Ethernet:** Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network secure
UNIT V	**Wireless Embedded Networking:** Wireless sensor networks – Introduction – Applications – Network Topology – Localization –Time Synchronization - Energy efficient MAC protocols –SMAC – Energy efficient and robust routing – Data Centricrouting

TEXT BOOKS	
1.	Embedded Systems Design: A Unified Hardware/Software Introduction - Frank Vahid, Tony Givargis, John & Wiley Publications, 2002.
2.	Parallel Port Complete: Programming, interfacing and using the PCs parallel printer port -Jan Axelson, Penram Publications, 1996
REFERENCE BOOKS	
1.	Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F series - Dogan Ibrahim, Elsevier2008
2.	Embedded Ethernet and Internet Complete - Jan Axelson, Penram publications,2003
3.	Networking Wireless Sensors - Bhaskar Krishnamachari ÀÛÜ, Cambridge press2005
WEB RESOURCES	
1.	https://www.highintegritysystems.com/rtos/rtos-training-videos/