### SANT LONGOWAL INSTITUTE OF ENGINEERING. & TECHNOLOGY, (Deemed University) LONGOWAL, DISTT. SANGRUR

Dated 01-09-2017

### MINUTES OF MEETING OF BOS FOR M.TECH PROGRAMME (ELECTRONICS & COMMUNICATION ENGINEERING)

The following committee (internal experts) in the Board of Studies of Departmentof ECE was approved by the Competent Authority and same was notified vide Ref. No. SLIET/ECE/31-32 dated 13.04.2016 to complete the process of finalizing scheme, syllabus of PG, UG and ICD programmes as per outcome based education (OBE):

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A meeting of above committee is held on 01.09.2017 to consider the recommendations dated 24.07.2017 of Departmental Academic Affair Commtitee (DAAC) regarding mapping of COs and POs of all the M.Tech courses and discrepancies between the contents of following courses, reported by the Course Coordinators:

Sr. No	Course	Name of Course Coordinator
1	List of experiments for the course ECP-514	Er. Kuldeep Singh, AP (ECE)
	List of Experiments for the course EC-817	Dr. Ajay Pal Singh, AsP (ECE)

Since, Dr. Anupma Marwaha, Profossor (ECE) has taken over the charge of HOD (ECE), she acted as Chairperson of the Committee.

The committee members have verified and endorsed the recommendations of the DAAC and decided to implement /incorporate the changes in the syllabus of courses ECT-514, ECP-514 and EC-817 suggested by the Course Coordinators from the Odd Semester of 2017-18.

Member

(Sarbjeet Singh)

Member

Member

(Dilip Kumar)

Member

(Ajay Pal Singh)

Member

(Surinder Singh)

(Anupra Marwaha)

Member

Chairperson

EXTERNAL MEMBERS

(Dr. Ranjil Kam) hof., ECE, Phi Univ. Patiale.

(Ar. Manoj Duhan. Isof, chaisman ECE Dept, DCRUST Musthal.

Rajign (De Rajin), Prof. ECE, Sissere, Fewerepers

# SANT LONGOWAL INSTITUTE OF ENGINEERING. & TECHNOLOGY, (Deemed University) LONGOWAL, DISTT. SANGRUR

#### **DEPARTMENT OF ECE**

Ref. No: SLIET/ECE/1846A

Date: 24/7 207)

# MINUTES OF DEPARTMENTAL ACADEMIC AFFAIR COMMITTEE (DAAC)

A meeting of Departmental Academic Affair Committee (DAAC) is held on 24.07.2017 at 10.00 AM in the office of HOD (ECE) to discuss following syllabus related matters.

 Approve minor revisions in the CO-PO mapping of M.Tech syllabus (2016 batch onwards)

• Consider the case of discrepancy in the contents of practical course on Electronic Devices & Circuits (EC-514).

 Minor modifications in List of Experiments for M.Tech course Digital Logic Design Lab (EC-817).

#### Following were present:

1. HOD (ECE)

- 2. Dr. J.S. Ubhi, Professor, Department of ECE
- 3. Dr. Dilip Kumar, Associate Professor (ECE)
- 4. Er. Vivek Harshey, Assistant Professor (ECE)

The DAAC discussed the correlation criteria in the COs and POs and finalized the mapping of all the M.Tech courses.

The matter of discrepancy between the contents of theory course (ECT-514) and practical course (ECP-514) has been reported by Er. Kuldip Singh, Asstt. Prof. (copy attached). The same has been discussed in DAAC and the list of experiments for the practical course (ECP-514) has been finalized in consultation with the course coordinator.

Minor modifications in the List of Experiments for M.Tech course Digital Logic Design Lab (EC-817) have been suggested by the course coordinator Dr. Ajay Pal Singh, Assoc. Prof. (copy attached). As discussed in DAAC, the proposed changes cover the Theory contents and the list of experiments for the practical course (EC-817) is therefore recommended for implementation.

It has also been decided that the cases may be put up before external experts visiting the Department from time to time for recommendations.

(Dilip Kumar)

(Vivek Harshey)

Anupma Marwaha)<sup>2</sup>

Chairman DAAC/ HOD (ECE)



Teaching Scheme for B.Tech Program (applicable to 2016 batch onwards)

						ECP-	-514						
				F	lectror	nic Devi	ces & (	Circuits	3				
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	-	3. De 4. Ab pre	sign an ility to epare a Mappin PO3	d analy measu formal ng of C	re and laboration	record tory rep Outcor	the export.	th prog	gram o	utcome	s		PO13

#### List of Experiments:

- 1. Design and analysis of full wave rectifier with and without LC filter.
- 2. To observe V-I characteristics of PNP & NPN transistor in common collector configuration.
- 3. To observe V-I characteristics of JFET in common source configuration.
- 4. To observe V-I characteristic of D- MOSFET.
- 5. To observe V-I characteristic of E- MOSFET.
- 6. To observe and analyze V-I characteristic of SCR.
- 7. To observe and analyze V-I characteristic UJT.
- 8. To observe and analyze various diode Clamping circuits.
- 9. To observe and analyze various diode Clipping circuits.
- 10. To observe and analyze V-I characteristic of Tunnel diode.
- 11. To observe and analyze V-I characteristic of PIN diode.
- 12. To observe and analyze V-I characteristic of Schottky Barrier diode.

(Dr Rangit Com) Gotund Report ( In Herry Duhan)

Department of Electronics & Communication

Kuldin Sinoh

Vivel Harshey

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# SANT LONGOWAL INSTITUTE OF ENGINEERING. & TECHNOLOGY, (Deemed to be University) LONGOWAL, DISTT. SANGRUR

### **DEPARTMENT OF ECE**

Dated 13-12-2019

# MINUTES OF MEETING OF BOS FOR B.E. AND M.TECH PROGRAM (ELECTRONICS & COMMUNICATION ENGINEERING)

A meeting of the Board of Studies (BOS) was held on 13-12-2019 in the Department of Electronics and Communication Engineering for Curriculum Revision of B.E. and M. Tech. Programs of ECE Department as per Guidelines of AICTE to be implemented from Academic session 2018-19.

Following members of the BOS took active participation in the same:

1.	Dr. Anupma Marwaha, Professor and Head (ECE)	Chairperson
2.	Dr A.P. Singh, Professor (ECE)	Member
3.	Dr. Jagpal Singh Ubhi, Professor (ECE)	Member
4.	Dr. AjayPal Singh Professor (ECE)	Member
5.	Dr. Dilip Kumar, Professor (ECE)	Member
6.	Er. Pankaj Kumar Das, Assist. Professor (ECE)	Member
7.	Er. Vivek Harshey, Assist. Professor (ECE)	Member
8.	Er. Sarbjeet Singh, Assistant Professor (ECE) - UG Coordinator	Member
9.	Dr. S.P. Sood, Associate Director, C-DAC, Mohali, Punjab	External Expert
10.	Dr. Kulbir Singh, Professor (ECE), TIET, Patiala	External Expert
11.	Dr. Ankush Kansal, Associate Professor, TIET, Patiala	External Expert

The following were the Agenda items regarding Curriculum Revision of B.E. and M. Tech. Programs of ECE Department as per outcome based education implemented from Academic session 2018-19:

- 1. Finalize the syllabus of B.E. and M. Tech. program (ECE) for 2K18 batch onwards.
- 2. To update the program specific outcomes for UG program for 2K18 batch onwards.
- 3. Redefining labs as per syllabus for 2K16 batch and 2K18 batch.
- 4. To deliberate on the inclusion of courses for Honors degree in Electronics and Communication Engineering.

5. To analyze the CO-PO mapping.

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During the sessions, the syllabus of B.E. and M. Tech. program was discussed at length and the recommendations of the committee are as follows:

- 1. The contents of syllabus for B.E. and M. Tech. (ECE) program for 2K18 batch onwards has been prepared by the respective program committee in consultation with DAAC and hereby approved for implementation (original copy attached).
- 2. One more PSO is recommended to be included in the curriculum of B.E. program (2K18 batch) already defined program specific outcome for B.E. program (2K16 batch). The PSO finalized are as follows:

**PSO1**: Ability to participate successfully in competitive examinations, career advancement and higher studies with professional ethics.

<u>PSO2</u>: Ability to solve real world problems in Electronics and Communication Engineering using state of art techniques, along with analytical and managerial skills. As per the Course Curriculum requirement of current UG/PG programs there is need to

establish Microwave and Antenna Lab. So it is recommended that the Basic Communication Lab (Room No. E-202) may be redefined as Microwave Engineering. Further the partitioning of Room No. E-202 is redefined as Broadband Communication and Electromagnetic Measurements Lab.

- 3. All the members deliberated on the scheme/syllabus to start Honors Degree in Electronics and Communication Engineering. The courses will be prepared by the B.E. program committee for implementation in the next session.
- 4. The mapping of COs with POs and PSOs has been analyzed and modified as per suggestions of all members.

The recommendations of the committee are submitted for approval of competent authority.

(Vivek Harshey)

AP (ECE)

(Pankaj Das) 13·12·19

AP (ECE)

(Sarbjeet Singh)

AP (ECE)

(J.S. Ubhi)

Prof. (ECE)

(A.P.Singh)

Prof. (ECE)

(Ajay Pal Singh)

Prof. (ECE)

(Dilip Kumar)

Prof. (ECE)

(Kulbir Singh)

External Expert

(S.P. Sood)

External Expert

(Ankush Kansal)

External Expert

(A. Marwaha)

Prof. & HOD

**DEAN (ACADEMICS)** 



# SANT LONGOWAL INSTITUTE OF ENGINEERING. & TECHNOLOGY, (Deemed to be University) LONGOWAL, DISTT. SANGRUR

#### DEPARTMENT OF ECE

Dated 22-05-2018

# MINUTES OF MEETING OF BOS FOR M.TECH PROGRAMME (ELECTRONICS & COMMUNICATION ENGINEERING)

A neeting of the Board of Studies (BOS) was held on 22.05.2018 in the Department of Electronics and Communication Engineering for Curriculum Revision of B.E. and M. Tech. Programmes of ECE Department as per Guidelines of AICTE to be implemented from Academic session 2018-19.

Following members of the BOS took active participation in the same:

1.	Dr. Anupma Marwaha, Professor and Head (ECE)	Chairperson
2.	Dr A.P. Singh, Professor (ECE)	Member
3.	Dr Surinder Singh, Professor (ECE)	Member
4.	Dr. Jagpal Singh Ubhi, Professor (ECE)	Member
5.	Dr. Lakhvinder Singh Solanki, Assoc. Professor (ECE)	Member
6.	Dr. Dilip Kumar, Assoc. Professor (ECE)	Member
70	Er. Pankaj Kuman Das, Assist. Professor (ECE)	Member
8.	Er. Vivek Harshey, Assist. Professor (ECE)	Member
9.	Dr. R.K. Sarin, Prof.& HOD, (ECE), NIT, Jalanchar	External Expect
10.	Dr. S.P. Sood, Joint Director, C-DAC, Mohali, Punjab	External Expert
11.	Mr. Munish Goyal, J. A.O, BSNL, Sangrur	Alumni
12.	Sh. Vijay Prashar, SLIET, Longowal	Parent of concurrent student

During the sessions, the course curriculum of B.E. and M. Tech. programme (ECE) as per AICTE model curriculum guidelines was discussed at length and the recommendations of the committee are as follows:

1. To encourage the innovation and research in the field of Electronics & Communication,

new courses have been introduced.

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- 2. The schemes for B.E. and M. Tech. programme (ECE) have been prepared maintaining the total credit structure of 160 credits.
- 3. The detailed contents of various courses have been discussed and the outcome of the contents will be finalized later on by internal BOS.

The schemes for B.E. and M. Tech in Electronics and Communication Engineering are enclosed herewith for approval and further ratification in the senate. Further, HOD (ECE) may be authorized to make changes in scheme/syllabi, if required.

(Vivek Harshey)
AP (ECE)

(I.S. Obhi) Prof. (ECE)

(Munish Goyal) (BSNL Sangrur) Alumni (Pankaj Das) AP (ECE)

(Surinder Singh)
Prof. (ECE)

(S.R. Sood) 22 (S.P. Sood) Prof. (ECE)
External Expert

(Dilip Kumar) AsP (ECE)

(A.P.S. Pharwaha) Prof. (ECE)

(R.K. Sarin)

Prof. (ECE) External Expert (L. S. Solanki) AsP (ECE)

(Vijay Prashar)
Parent

(A. Marwaha)

Prof. & HOD (ECE)

# SANT LONGOWAL INSTITUTE OF ENGINEERING. & TECHNOLOGY, (Deemed to be University) LONGOWAL, DISTT. SANGRUR

### **DEPARTMENT OF ECE**

Dated 24-05-2018

# MINUTES OF MEETING OF BOS FOR M.TECH PROGRAMME (ELECTRONICS & COMMUNICATION ENGINEERING)

A meeting of all internal members of Board of Studies (BOS) was conducted on 24.05.2018 in the Department of Electronics and Communication Engineering to discuss the following Agenda items regarding Curriculum Revision of B.E. and M. Tech. Programmes of ECE Department as per Guidelines of AICTE to be implemented from Academic session 2018-19:

- 1. Freeze the UG syllabus for 2K16 batch
- 2. Finalize the contents of PG syllabus for 2K18 batch onwards
- 3. Discuss the contents of UG syllabus for 2K18 batch onwards
- 4. Redefining labs as per syllabus for 2K16 batch and 2K18 batch

## Following are the recommendations of the committee:

- 1. Few discrepancies in the contents of UG programme for 2K16 batch onwards have been reported to the DAAC during the last academic year 2017-18. Accordingly, corrections were incorporated, and the syllabi were modified by the concerned course coordinators. Now the syllabus has been finalized and approved for implementation for the UG programme for 2K16 batch onwards.
- 2. The contents of syllabus for M. Tech. (ECE) programme for 2K18 batch onwards has been prepared by the M. Tech. programme committee and hereby approved for implementation (original copy attached).
- 3. The B.E. programme committee of ECE Department has submitted the syllabus for the common course Elements of Electronics Engineering (ESEC-401) to be offered to the 1<sup>st</sup> year students of 2K18 batch (original copy attached). The BOS members recommend to implement the syllabus for Elements of Electronics Engineering (ESEC-401). Further it has been decided that the contents of courses from 2<sup>nd</sup> yr onwards may be again discussed and input may be taken from concerned faculty coordinators for incorporating the latest topics in Electronics & Communication Engineering as per AICTE guidelines. The contents of various courses of B.E. (ECE) programme for 2K18 batch from 2<sup>nd</sup> yr onwards will therefore be implemented later.

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4. As per the Course Curriculum requirement of current UG/PG programmes there is need to establish Microwave and Antenna Lab. So it is recommended that the Basic Communication Lab (Room No. E-202) may be redefined as Microwave Engineering. Further the partitioning of Room No. E-202 is redefined as Broadband Communication and Electromagnetic Measurements Lab.

(Vivek Harshey)

AP (ECE)

(Pankaj Das)

AP (ECE)

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(Dilip Kumar) AsP (ECE)

(L. S. Solanki) AsP (ECE)

(Surinder Singh) Prof. (ECE)

(A.P.S. Pharwaha) Prof. (ECE)

Prof. & HOD (ECE)

**DEAN (ACADEMICS)** 

# **MINOR DEGREE**

		Semester-	III				
S.No.	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1.	MDEC-511	Digital Circuits and Logic Design	3	1	0	4	4
		Total	3	1	0	4	4
		Semester-	IV				
S.No.	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1.	MDEC-521 Microcontroller		3	1	0	4	4
		Total	3	1	0	4	4
		Semester-	-V				
S.No.	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1.	MDEC-61	1 Communication System	3	1	0	4	4
		Total	3	1	0	4	4
		Semester-	VI	1	•	•	
S.No.	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1.	MDEC-62	·	3	1	0	4	4
		Total	3	1	0	4	4
		Semester-	VII	1	•	•	•
S.No.	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1.	MDEC-711	Signal Processing	3	1	0	4	4
		Total	3	1	0	4	4

# **HONORS DEGREE**

	Semester-VA								
S.No.	Sub Code	Subject Name	L	T	P	Hrs.	Credits		
1.	HDEC-611	AI & Machine Learning	3	1	0	04	4		
2.	HDEC-612	Optoelectronics Devices & Circuits	3	1	0	04	4		
		Total	06	02	00	08	08		

		Semester-VI-A					
S.No.	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1.	HDEC-621	Circuit Design for Electronics system	3	1	0	04	4
		Total	03	01	0	04	04

		Semester-VII						
S.No.	Sub Code	Subject Name		L	T	P	Hrs.	Credits
1.	HDEC- 711	Internet of Things & its applications		3	1	0	04	4
			Total	03	01	0	04	04

		Semester-VIII						
S.No.	Sub Code	Subject Name	L	T	P	Hrs.	Credits	
1.	PHEC-721	Project Hon's	0	0	08	08	4	
		Total	0	0	0	08	04	



## **HONORS DEGREE**

	Semester-VA								
S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits		
1.	HDEC-611	AI & Machine Learning	3	1	0	04	4		
2.	HDEC-612	Optoelectronics Devices & Circuits	3	1	0	04	4		
	Total 06 02 00 08 08								

		Semester-VI-A						
S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits	
1.	HDEC-621	Circuit Design for Electronics system	3	1	0	04	4	
		Total	03	01	0	04	04	

		Semester-VII										
S.No	Sub Code	Subject Name	${f L}$	T	P	Hrs.	Credits					
1.	HDEC-711	Internet of Things & its applications	3	1	0	04	4					
		Total	03	01	0	04	04					

	Semester-VIII											
S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits					
1.	PHEC-721	Project Hon's	0	0	08	08	4					
		Total	0	0	0	08	04					



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Upon completing the course, students will acquire the knowledge of applying Machine Learning														
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learning software for solving practical problems. To gain experience of doing independent study														
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		appli	ications	•										
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CO2	3	3	2	1	1	1	2	1	1	0	3	2	3	2
CO3	3	3	3	3	2	2	2	1	1	0	3	2	3	3
CO4	3	3	3	1	3	1 2 T		1	1	0	3	2	2	<u>3</u>
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The Problem of Overfitting, Probability Theory Review, Python/Numpy introduction, Kernels. SVM, Neural

Optimization Techniques, Gradient Descent and its variants, Batch Optimization, Momentum Optimizer,

RMSProp, Adam.



Networks, Multilayer Perceptron, Backpropagation, Applications of Backpropagation, Deep Neural Networks, Effective training in Deep Net- Early stopping, Dropout, Batch Normalization, Instance Normalization

Unit-IV 12 hrs

Convolutional Neural Network: CNN Operations, Building blocks of CNN, Transfer Learning, Discriminative Training, Transfer Learning Applications, Unsupervised Learning with Deep Network, Autoencoders, Generative Adversarial Networks.

	Recommended Books	
Title	Author	Publisher
1. Artificial Intelligence	Rich and K. Knight	Tata McGraw Hill
2. Neural networks and learning machines	S. Haykin.	Pearson 2008.
3. Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer 2007.
4. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurelien Geron	O'Reilly. (2019).



			Opto	electro	HDE onics D	C-612 Devices	& Circ	cuits				
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Course Objectives  Course Outcomes	Objectives   devices and circuits by using different design technologies used for design of optoelectronics devices. Implementation approach of optoelectronics devices in modern communication system. To study the design and evaluation of modern optoelectronics integrated systems.    Course   1. Use principles of physics to analyze the fundamental concepts of various optoelectronics											ign of modern tronics
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CO2 3	3 3	3	3	2	0	1	2	2	3	0	2	3
CO3 3	3 2	2	3	0	1	1	2	2	3	0	2	3
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**Introduction:** Semiconductors, optical waves, photon generation, optoelectronics, need of optoelectronics, advantages, applications-network, military, civil, industrial, sensors etc.

Unit-II 12 hrs

**Optoelectronic sources**: Introduction, basic concepts, optical emission from semiconductor, semiconductor injection laser & its various structures, injection laser characteristics, threshold condition, wavelength tunable lasers, LED power and efficiency, heterojunction, LED structure designs, characteristics, modulation response of an LED.

**Optoelectronic detectors:** Introduction, device types, basic principle of optoelectronic detection, absorption, quantum efficiency, responsivity, wavelength cut-off, types of photodiodes with and without internal gain, mid-infrared photodiode, phototransistors, photo conducting detectors, noise considerations



#### **Unit-III**

12 hrs

**Passive network components & sensors:** Introduction, couplers/splitters, WDM multiplexers, demultiplexers, filters, isolators, circulators, attenuators, electro-optic modulators, acousto-optic modulators and their application areas, optical sensors: classification-point, distributed, intensity, phase & spectral. smart structures & applications

**Optical amplifiers and integrated optics:** Introduction, semiconductor optical amplifiers (SOA), erbium-doped fiber amplifiers (EDFA), fiber Raman amplifiers (FRA), application areas of optical amplifiers, some integrated optical devices, OEICs, optical bi-stability and digital optics, optical computation.

<u>Unit-IV</u> 12 hrs

**Optoelectronic integrated circuits:** Introduction, hybrid and monolithic integration, application of opto electronic integrated circuits, integrated transmitters and receivers, guided wave devices.

Title	Author	Publisher
1. Semiconductor Optoelectronic Devices	Pallab Bhattacharya	Pearson Education Inc
2. Photonics - Optical Electronics in Modern Communications	A. Yariv and P. Yeh,	Oxford University Press
3.Opto Electronics – As Introduction to materials and devices	Jasprit Singh	McGraw-Hill International
4.Opto Electronics – An Introduction	J. Wilson and J. Haukes	Prentice Hall, 1995



							HDE	C-621							
					Circui	it Desig	n for l	Electro	nics Sy	stems					
				L			T			P			Credit	S	
				3			1			0		4			
		S	ession	al Mar	ks							50			
		E	nd Sei	nester	Exam	ination	Mark	S				50			
Course The objective of this course is to provide adequate theoretical and practical k											cal kno	wledge			
Objec	Objectives about the components required for electronic circuit design. Next focus is to get students														
	familiarize with the concepts of design of power supply, heat sink, and amplifiers														
Cours	Course 1. Explain and identify the devices which can be used in applications like power supply,												upply,		
Outco	mes		ampli	fiers et	c										
		2.	Desig	n linea	r and v	ariable	power	supply	in pow	er effic	ient manr	ner			
		3.	Read	data sh	eets, d	esign ar	nd deve	elop am	plifiers	s using t	ransistors	s and op	-amps.		
		1.	Desig	n diffe	rent ba	se drive	circui	ts		_			_		
			M	appin	g of Co	ourse O	utcon	es witl	h Progi	ram Ou	tcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	1	1	1	3	1	1	1	3	3	3	3	3	
603	3	3	3	1	2	2	2	1	1	3	2	3	3	2	
CO2	3	3	3	1	4			1	1	3	<u>_</u>	3	3	4	
CO3	CO3         3         1         3         2         1         1         1         1         3         3         1         3								3	3					
CO4	3	1	3	3	1	1	1	1	1	1	3	3	2	2	
	I	I	I	I	1	Uı	nit-I	<u> </u>	I	I.	1	ı	1	2 hrs	

**INTRODUCTION:** Review of transistor basis-transistor as a switch, transistor as amplifier, problems in the transistor amplifier, temperature drift and device to device variation and their solution, use of op-amp for different applications and basic issues in use of op-amps.

<u>Unit-II</u> 12 hrs

**POWER SUPPLY DESIGN:** Designing a linear power supply using transistor and op amp, selection of components, design of heat sink, design of inductor, design of transformer for the linear power supply, selection of core material, insulating materials and wires, comparison of linear power supply with SMPS and design of low drop out regulators.

Unit-III 12 hrs

**SMPS DESIGN:** Study of PWM control ICs, design of base drive circuits, design of temperature indicator using IC sensors, thyristor and transistor-based drive circuit design, use of pulse width modulation circuits and short circuit protection techniques.

Unit-IV 12 hrs

**ELECTRONIC CIRCUIT DESIGN:** Design of an amplifier, design of an on/off temperature controller, design of different types of heater drive circuits, errors due to resistance drift, op amp offset voltage drift, offset current drift, importance of grounding, high frequency ground method, low frequency ground method and error budgeting.

Department of Electronics & Communication

Page 6



RECO	MMENDED BOOKS	
Title	Author	Publisher
1. The Art of Electronics	Paul Horowitz	Cambridge University Press
2. Design with Operational Amplifiers and Analog Integrated Circuits	Sergio Franco	McGraw Hills



							HDE	C-711						
					Inter	net of	Things	and its	Appli	ications	S			
			I			,	T			P				
			3				0			0				3
		Sessional Marks 50										50		
		End Semester Examination Marks 50											<b>50</b>	
Cour Obje	rse ctives	for set is good thing	This course focuses on hands-on Internet of Things (IoT) concepts such as sensing, actuation, and communication. It covers the development of prototypes—including devices for sensing, actuation, processing, and communication. The IoT is the next wave the world is going to witness. Today we live in an era of connected devices the future is of connected things. Therefore, it is very important to learn the fundamentals of this emerging technology.											
Cour	se	1.	Toι	unders	tand t	he fund	lamenta	ls of lo	Γ.					
Outc	omes	2.	Cho	ose be	etweer	n availa	ble tech	nologi	es and	devices	for stat	ed Io7	Γ challer	nge
		3.	To l	earn t	o imp	lement	secure i	nfrastr	icture	for IoT				
		4.	To l	earn r	eal wo	orld app	olication	scenai	ios of	IoT alo	ng with	its so	cietal an	d
			ecor	nomic	impa	ct using	g case st	udies						
		5.	Imp	lemen	it an a	rchitect	tural des	sign for	IoT fo	or speci	fied requ	uireme	ent	
				Map	ping o	f cours	e outcon	nes witl	ı progı	ram out	comes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO<sub>1</sub> CO<sub>2</sub> CO<sub>3</sub> **CO4** CO<sub>5</sub> Unit-I 6 hrs.

**Introduction:** Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

Unit-II 10 hrs.

**Introduction to Python**: Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling. Python packages

Unit-III 8 hrs

**IoT Physical Devices and Endpoints**: Introduction to Arduino and Raspberry Pi - Architecture, Programming and Application, Python program with Raspberry Pi with focus of interfacing external gadgets, controlling output, reading input from pins.

Unit-IV 8 hrs.

**IoT Physical Servers and Cloud Offerings:** Introduction to Cloud Storage models and communication APIs. Webserver – Web server for IoT, Cloud for IoT, Various IoT security issues and need, challenges and algorithms

Department of Electronics & Communication

Page 8



RE	COMMENDED BOOKS	
Title	Author	Publisher
1. Internet of Things with Raspberry Pi and Arduino	Rajesh Singh, Anita Gehlot	CRC Press
2. Raspberry Pi for Arduino Users: Building IoT and Network Applications and Devices	James Strickland	Apress
3. Internet of Things: Architecture and Design Principle	Raj Kamal	McGraw Hill Education
4. "Internet of Things (A Hands-on-Approach)",	Vijay Madisetti and Arshdeep Bagha	1stEdition, VPT, 2014. (ISBN: 978- 8173719547)

# Course Curriculum for Degree Programme in Electronics & Communication Engineering



# **Department of Electronics & Communication Engineering**

Sant Longowal Institute of Engineering & Technology Longowal-148106

Phone: 01672-253117 Fax: 01672-280057

Website: www.sliet.ac.in



#### **VISION**

The Department of Electronics & Communication Engineering shall strive to create engineering technocrats for addressing the global challenges in relevant areas to cater the ever-changing needs of society at National and International level.

#### **MISSION**

- 1. To ensure dissemination of knowledge through effective teaching and learning in Electronics and Communication Engineering.
- 2. To excel in Research and Development activities in emerging areas.
- 3. To promote industry-institute and institute-institute linkages for sustainable development of academic, research, training and placement activities.
- 4. To establish centre of excellence in thrust areas to nurture the spirit of innovation and creativity among faculty and students.



#### **Programme Educational Objectives (PEOs)**

- 1. To be well acquainted with fundamentals of Electronics & Communication Engineering for leading a successful career in industry or as an entrepreneur or pursuing higher education.
- 2. To inculcate rational approach towards constantly evolving technologies with ethical responsibilities.
- 3. To foster techno-commercial skills for innovative solutions in Electronics & Communication Engineering or related areas.
- 4. To participate in life-long learning in the relevant domain for addressing global societal needs.

#### **Programme Outcomes (POs)**

After successful completion of B.E. (Electronics & Communication Engineering) program, the engineering graduates will be able to:

- 1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- 6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. **Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.



- 10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **12. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

#### PROGRAM SPECIFIC OUTCOMES (PSOs)

**PSO1:** Ability to participate successfully in competitive examinations, career advancement and higher studies with professional ethics.

**PSO2**: Ability to solve real world problems in Electronics and Communication Engineering using state of art techniques, along with analytical and managerial skills.

Department of Electronics & Communication

Page 3



## **B.E.** (Electronics and Communication Engineering)

		Semester-I (Gro	oup-A)				
S.No.	Sub Code	Subject Name	L	Т	Р	Hrs.	Credits
1	BSMA-401	Engineering Mathematics I	3	1	0	4	4
2	BSPH-401	Applied Physics	3	1	0	4	4
3	ESEE-401	Elements of Electrical Engineering	2	1	0	3	3
4	ESCS-401	Elements of Computer Engineering	2	0	0	2	2
5	ESEC-401	Elements of Electronics Engineering	2	0	0	2	2
6	BSPH-402	Applied Physics Lab	0	0	2	2	1
7	ESEE-402	Elements of Electrical Engineering Lab	0	0	2	2	1
8	ESCS-402	Elements of Computer Engineering Lab	0	0	4	4	2
9	ESEC-402	Elements of Electronics Engineering Lab	0	0	2	2	1
		Total	12	3	10	25	20
		Semester-II A (G	roup-A)				
S.No.	Sub Code	Subject Name	L	Т	Р	Hrs.	Credits
1	BSMA-402	Engineering Mathematics II	3	1	0	4	4
2	BSCH-401	Applied Chemistry	3	1	0	4	4
3	ESME-401	Elements of Mechanical Engineering	2	1	0	3	3
4	ESME-402	Workshop Technology and Practice	1	0	0	1	1
5	HSMC-401	English Communication and Soft Skills	1	0	0	1	1
6	BSCH-402	Applied Chemistry Lab	0	0	2	2	1
7	ESME-403	Elements of Mechanical Engineering Lab	0	0	2	2	1
8	ESME-404	Engineering Drawing	0	0	4	4	2
9	ESME-405	Workshop Technology and Practice Lab	0	0	4	4	2
10	HSMC-402	English Communication and Soft Skills Lab	0	0	2	2	1
11	MCCH-401	Environmental Studies	3	0	0	3	0
		Total	13	3	14	30	20
	1	Semester-I	I-B				_
	TPIN-421	Practical Training During Summer Vacations (In-house) 02 weeks	0	0	40	40	1 (S/US)
	TPIN-422	Technical Competency	0	0	40	40	1 (S/US)

Department of Electronics & Communication

Page 4

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi A. Marwaha



क्रमेसु केश्वि							
		Semest	er-III	_			
S.No.	Sub Code	Subject Name	L	Т	P	Hrs.	Credits
1	BSMA-501	Numerical and Statistical Methods	3	0	0	3	3
2	PCEC-511	Network Analysis & Synthesis	2	1	0	3	3
3	PCEC-512	Digital System Design	2	1	0	3	3
4	PCEC-513	Signals & Systems	2	1	0	3	3
5	PCEC-514	Electronic Devices & Circuits	2	1	0	3	3
6	BSBL-501	Biology for Engineers	2	0	0	2	2
7	BSMA-502	Numerical and Statistical Methods Lab	0	0	2	2	1
8	PCEC-515	Digital System Design Lab	0	0	4	4	2
		Total	14	03	06	23	20
		Semeste	r-IV-A	_			
S.No.	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1	ESME-501	Engineering Mechanics	3	1	0	4	4
2	PCEC-521	Analog Communication	3	0	0	3	3
3	PCEC-522	Analog Electronic Circuits	2	1	0	3	3
4	PCEC-523	Microprocessor & Microcontroller	3	0	0	3	3
5	HSMC-501	Principles of Management	3	0	0	3	3
6	PCEC-524	Analog Electronic Circuits Lab	0	0	4	4	2
7	PCEC-525	Microprocessor & Microcontroller Lab	0	0	4	4	2
8	MCMH - 501	Constitution of India	3	0	0	3	0
		Total	17	02	8	27	20
		Semester-IV	/-B		T	T	T
	TPID-521	Industrial Training 02 weeks	0	0	40	40	1 (S/US)
	EAA-521+	Fractional credit course/Extra Academic Activity +GROUP A/B/C	0	0	40	40	1 (S/US)
		Semester-\	/A	_			
S.No.	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1	PCEC-611	Digital Communication	3	0	0	3	3
2	PCEC-612	EMF & Transmission Lines	3	0	0	3	3
3	OEEC-611	Open Elective-1	3	0	0	3	3
4	OEEC-612	Open Elective-2	3	0	0	3	3
5	PEEC-611	Professional Elective-1	3	0	0	3	3
6	HSMC-601	Technical Communication	2	0	0	2	2
7	PCEC-613	Analog & Digital Communication Lab	0	0	4	4	2
8	HSMC-602	Technical Communication Lab	0	0	2	2	1



stil app											
		Tota	al	17	0	6	23	20			
9*	HDEC-611	Hon's Subject-1						4			
10*	HDEC-612	Hon's Subject-2						4			

		Semester-\	/B										
	EAA-611+	Fractional credit course/Extra Academic Activity +GROUP A/B/C	0	0	40	40	1 (S/US)						
		Comparts.	\/I A										
C 21 -		Semeste		l –			0						
S.No.	Sub Code	Subject Name	L	T	P	Hrs.	Credits						
1	PCEC-621	Linear Integrated Circuits	2	1	0	3	3						
2	PCEC-622	Wireless Communication	3	0	0	3	3						
3	OEEC-621	Open Elective-3	3	0	0	3	3						
4	OEEC-622	Open Elective-4	3	0	0	3	3						
5	PEEC-621	Professional Elective-2	3	0	0	3	3						
6	HSMC-603	Engineering Economics and Entrepreneurship	3	0	0	3	3						
7	PCEC-623	Linear Integrated Circuits Lab	0	0	2	2	1						
8	PCEC-624	MATLAB Programming Lab	0	0	2	2	1						
		Total	17	1	4	22	20						
9*	HDEC-621	Hon's Subject-3					4						
	Semester-VI-B												
	TPID-621	Industrial Training 04 weeks	0	0	40	40	2(S/US)						
	EAA-622+	Fractional credit course/Extra Academic Activity +GROUP A/B/C	0	0	40	40	1 (S/US)						
		Semest	er-VII	ı	T	1							
S.No.	Sub Code	Subject Name	L	Т	Р	Hrs.	Credits						
1	PCEC-711	Digital Signal Processing	3	0	0	3	3						
2	PCEC-712	Antenna and Wave Propagation	3	0	0	3	3						
3	PEEC-711	Professional Elective-3	3	0	0	3	3						
4	PEEC-712	Professional Elective-4	3	0	0	3	3						
5	OEEC-711	Open Elective-5	3	0	0	3	3						
6	PCEC-713	Digital Signal Processing Lab	0	0	2	2	1						
7	PCEC-714	Antenna and Microwave Lab	0	0	4	4	2						
8	PREC-711	Project Stage I and Seminar	0	0	4	4	2						
		Total	15	0	10	25	20						
9*	HDEC-711	Hon's Subject-4					4						
		Semeste	er-VIII										
S.No.	Sub Code	Subject Name	L	Т	Р	Hrs.	Credits						
1	PEEC-721	Professional Elective-5	3	0	0	3	3						
2	PEEC-722	Professional Elective-6	3	0	0	3	3						

Department of Electronics & Communication

Page 6

क्षांस क्रिक्								
3	PREC-721	Project Stage II		0	0	12	12	6
		Total		6	0	12	18	12
4*	PHEC-721	Hon's Project		0	0	08	08	4
		OR						
S.No.	Sub Code	Subject Name	ı		Т	Р	Hrs.	Credits
1	INID-721	Internship in Industry	(	)	0	40	40	6
2	PREC-721	Project Stage II	(	)	0	12	12	6
		Tot	al (	)	0	52	52	12
3*	PHEC-721	Hon's Project	(	)	0	08	08	4

<sup>\*</sup>For honor subjects

	Credit Structure of Undergraduate Engineering Program												
S.No.	Category	L	T	Р	Hrs.	Credits							
1	Humanities and Social Sciences including Management courses	9	0	4	13	11							
2	Basic Science courses	17	4	6	27	24							
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	12	3	18	33	24							
4	Professional core courses	34	5	26	65	52							
5	Professional Elective courses relevant to chosen specialization/branch	12	0	0	12	12							
6	Open subjects – Electives from other technical and /or emerging subjects	15	0	0	15	15							
7	Project work	0	0	12	12	6							
8	Seminar/Internship/ Industrial training	0	0	204	204	13							
9	Any others [Mandatory Courses and Fractional Credit Courses]	6	0	120	126	3							
			Total			160							

Department of Electronics & Communication

Page 7



#### **List of Professional Electives**

		Professional Elective-I									
S.No.	Sub Code	Subject Name									
1	PEEC-611A	Pulse and Digital Switching Circuits									
2	PEEC-611B	MEMS									
3	PEEC-611C	Information Theory & Coding									
	Professional Elective-II										
S.No.	Sub Code	Subject Name									
1	PEEC-621A	Control System Engineering									
2	PEEC-621B	Telecommunication Switching Systems & Networks									
3	PEEC-621C	MOS Device Physics & Modelling									
		Professional Elective-III									
S.No.	Sub Code	Subject Name									
1	PEEC-711A	Microelectronics									
2	PEEC-711B	Optoelectronics Devices & Circuits									
3	PEEC-711C	Computer Communication & Networks									
		Professional Elective-IV									
S.No.	Sub Code	Subject Name									
1	PEEC-712A	Microwave & Radar Engineering									
2	PEEC-712B	Computer Architecture & Organization									
3	PEEC-712C	Industrial Electronics									
		Professional Elective-V									
S.No.	Sub Code	Subject Name									
1	PEEC-721A	Wireless Sensor Networks									
2	PEEC-721B	Satellite Communication									
3	PEEC-721C	VLSI Circuits									
	Professional Elective-VI										
S.No.	Sub Code	Subject Name									
1	PEEC-722A	Fiber Optics Communication									
2	PEEC-722B	Electronic Measurement & Instrumentation									
3	PEEC-722C	Neural Networks & Fuzzy Logic									



### **List of Open Electives**

		Open Elective-I										
S.No.	Sub Code	Subject Name										
1	OEEC-611A	Linear Integrated Circuits										
2	OEEC-611B	Digital Electronics										
3	OEEC-611C	Electronic Measurement & Instrumentation										
	Open Elective-II											
S.No.	Sub Code	Subject Name										
1	OEEC-612A	Principle of Communication Engineering										
2	OEEC-612B	Optical Electronics										
3	OEEC-612C	MATLAB Programming										
	Open Elective-III											
S.No.	Sub Code	Subject Name										
1	OEEC-621A	Microprocessor and Applications										
2	OEEC-621B	VLSI Technology										
3	OEEC-621C	Nano Technology										
		Open Elective-IV										
S.No.	Sub Code	Subject Name										
1	OEEC-622A	Biomedical Electronics										
2	OEEC-622B	Control System Engineering										
3	OEEC-622C	Electronic System Design										
		Open Elective-V										
S.No.	Sub Code	Subject Name										
1	OEEC-711A	Digital Systems										
2	OEEC-711B	Microcontroller and Embedded Systems										
3	OEEC-711C	Wireless Communication										



	ESEC-401														
				E	lemen	ts of E	lectron	ics En	gineeri	ng					
				L			T			P		(	Credits	š	
				2			0			0			2		
		Sessi	onal M	arks									50		
		End	Semest	er Exa	aminat	ion M	arks					50			
Cours	<u>se</u>	The	aim of	this o	course	is to	provide	e an ir	ntroduc	tion an	d basi	c unde	rstandi	ng of	
Objec	ctives	semiconductor devices viz. diodes, bipolar junction transistors, junction field effect													
transistors and operational amplifiers to develop the ability to design basic electron												tronic			
circuits. The course also focuses on knowledge about number systems and logic circuit												rcuits			
introducing basic gates and flip-flops.															
Cours	<u>se</u>	1. I	Design s	simple	combi	nationa	al and s	equenti	ial logi	c circui	ts.				
Outco	omes	2. (	2. Characterize semiconductors, diodes and transistors.												
		3. A	Apply t	he bas	ics of	diode	and tra	ansisto	r to an	alyse tl	he ope	ration	of elec	tronic	
		d	levices.												
		4. I	Design e	electro	nic circ	cuits su	ch as re	ectifier	s, filter	s, volta	ge regu	ılators,	transis	tor	
		a	mplifie	rs and	operat	ional a	mplifie	rs.							
			Map	ping o	f Cou	rse Ou	tcomes	with p	orogra	m outc	omes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	3	1	1	1	3	1	1	0	0	2	1	2	2	
CO2	3	3	3	3	3	2	1	1	0	0	3	2	3	3	
CO3	3	3	0	0	0	0	0	1	0	0	1	0	3	2	
CO4	3	3	3	2	1	3	0	1	0	0	0	0	3	2	
	Unit-I 8 hrs														

**Number system and codes**: Decimal, binary, octal, and hexadecimal number system and their interconversions, Gray code, Excess-3 code.

**Logic gates and flip flops**: Definitions, symbols and truth table of NOT, OR, AND, NAND, NOR, XOR, XNOR gates, De-Morgan's theorems, realization of basic gates using universal gates; realization of simple Boolean equations using universal gates, introduction to K- map (3 variables), logic diagram, truth table and operation of latches and flip flops: RS, T, D, JK.

<u>Unit-II</u> 8 hrs

**Semiconductor devices**: Semiconductor materials: Ge, Si, intrinsic and extrinsic semiconductors, p-type, n-type, p-n junction theory and diodes, its V-I characteristic, equivalent model, diode applications- half wave, full wave and bridge rectifier circuits, filter circuits: inductor filters, capacitor filters, L- section filters,  $\pi$ - section filters, comparison of filters, clippers and clampers, Zener diode, its characteristics and application as a voltage regulator, LED, photodiode.

<u>Unit-III</u> 8 hrs

**Transistors**: Bipolar junction transistor (BJT): basic operation, biasing, concept of dc load line and operating point selection, CB, CE, and CC configurations, BJT as an amplifier and switch, introduction to JFET and MOSFET: construction and operation.

Unit-IV 8 hr

**Operational amplifiers (Op-Amps.)**: Introduction, basic characteristics of ideal and practical Op-Amp, IC741 pin configuration, Op-Amp in different modes: inverting and non-inverting amplifier, basic applications: adder, subtractor, voltage follower, multiplier, differentiator & integrator, instrumentation amplifier.



RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Electronic Devices & Circuits	David A. Bell	Oxford University Press, 5 <sup>th</sup> Edition 2010									
2. Electronic Devices & Circuits	J. Millman & Halkias	McGraw Hill Education 3 <sup>rd</sup> Edition 2010									
3. Electronic Devices & Circuit Theory	Robert L. Boylsted, Louis Nashelsky	Pearson Education									
4.Digital Systems: Principles and Applications	Ronald J. Tocci	PearsonEducation									



	ESEC-402													
				El	ement	s of El	ectron	ics En	gineer	ing Lab	)			
			I			7	Γ	J	P			Credits	3	
			(	)		(	)	2	2					
Cour	<u>se</u>	The a	im of t	his lab	is to gi	ve pra	ctical e	xposur	e to stu	udents b	y analyz	zing V-I	charact	eristics
Objec	ctives	of dif	of different semiconductor electronics devices and design of basic electronic circuits. This											ts. This
	<u> </u>	lab also includes verification and testing of truth table of various logic gates and flip flops.												
Cour	Course 1. Analyze and design various digital circuits using basic gates and flip flops.													
Outco	Outcomes 2. Design practical circuits using semiconductor diodes.													
	3 Analyze various modes of transistors in different configurations.													
		4. De	sign ci	rcuits 1	using t	ransist	ors and	l Op-A	mps.					
			Ma	pping	of Co	urse O	utcom	nes wit	h prog	gram ou	tcomes	1		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	3	3	2	2	0	1	3	2	1	2	1	3
CO2	3	2	2	3	2	2	Λ	1	2	2	1	0	1	2
CO2	3	3	3	3	2	2	0	1	3	2	1	U	1	2
CO3	3	3	0	3	2	2	0	1	3	2	1	2	2	3
CO4	3	3	3	3	2	2	0	1	3	2	1	2	2	3

#### **List of Experiments:**

- 1. Verification of the truth tables of basic gates, e.g., 7400, 7402, 7404, 7408, 7432, 7486.
- 2. Design all other gates using NAND and NOR gates.
- 3. Design S-R flip-flop using NOR/NAND gates.
- 4. Verify the truth table of J-K flip-flop (7476), D flip-flop (7474) and T flip-flop.
- 5. To observe and analyze V-I characteristics of PN junction diode.
- 6. To observe and analyze V-I characteristics of Zener diode.
- 7. Design and analysis of half wave rectifier with capacitor filter.
- 8. Design and analysis of center tap full wave rectifier with capacitor filter.
- 9. Design and analysis of bridge type full wave rectifier with capacitor filter.
- 10. Design and analysis of Zener as a voltage regulator.
- 11. To observe V-I characteristic of PNP and NPN transistor in common base configuration.
- 12. Design and analysis of Op-Amp as an inverting amplifier & non-inverting amplifier.
- 13. Design and analysis of Op-Amp as an integrator & differentiator.
- 14. To observe V-I characteristic of JFET.
- 15. To observe V-I characteristic of MOSFET.



कमसु	TPIN-421														
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<b>Object</b>	<u>ctives</u>	exper	ience (	on the	requisi	ite tool	ls, com	ponen	ts and	instrum	ents to	be used	in Elec	tronics	
		and (	and Communication Engineering. The students will be able to present their work in												
			written, oral or formal presentation formats.												
		*													
Cour	Course After successful completion of industrial training, the students should be able to														
Outco	<u>omes</u>	1. understand the use of various tools, electronic components and measuring													
				uments											
		2.					•	_	•			work sk	ills.		
		3.								ractical	-				
		4.										ommuni	cation.		
			Ma	pping	of Co	urse O	utcom	es wit	h prog	ram ou	tcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	2	2	2	2	2	3	3	3	1	3	3	1	
CO2	3	2	3	3	3	3	3	2	2	3	1	3	3	1	
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CO3	3	3	2	3	2	2	2	2	1	3	1	3	3	3	
CO4	1	1	1	1	1	1	1	1	2	2	1	2	1	2	
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	PCEC -511 Network Analysis and Synthesis															
				L	110	T T T	T	ois alla		P			Credits	3		
				2			1			0			3			
		S	ession	al Mai	rks	•						50				
		E	End Semester Examination Marks										50			
	Network analysis and synthesis is the foundation on which most other courses in the electronics and electrical engineering are based. The main objective of this course is to provide platform to understand analysis of different networks and provide knowledge of network synthesis.															
Course Outcomes  1. Apply basic circuital laws and simplify the network using reduction technique 2. Analyse circuits using Kirchhoff's laws and network simplification theorems. 3. Evaluate and compute transient response, steady state response, network func 4. Calculate two port network parameters. 5. Synthesize networks using Foster and Cauer forms.									orems.							
	1	Г			T		1			1	tcomes	T	T			
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CO2	2	2	2	2	2	2	0	1	1	0	1	2	3	1		
CO3	1	3 1 3 3 2 0 1 2 0 1 2								3	2					
CO4	3	3	2 3 2 2 0 1 1 0 0 2 3								2					
CO5	3	1	2	2 3 2 2 0 1 1 0 0 2 1												
	C .:	•4		• 15			nit-I	1 4	, ,		•.	1 . 1	12	hrs		

**Basics of circuit analysis**: Two terminal circuit elements (resistor, capacitor and inductor) and their characteristics, ideal voltage and current source, energy concepts in two terminal elements-Delta transformation, Kirchhoff's Laws, nodal and mesh analysis.

**Network theorems:** Superposition theorem, reciprocity theorem, Thevenin's theorem, Norton theorem, Millman's theorem, maximum power transfer theorem, substitution theorem, compensation theorem, Tellegen's theorem (for both AC and DC excitations).

Unit-II 12 hrs

**Two port networks**: Introduction to single and two port networks, parameters of two port networks such as impedance, admittance, hybrid, transmission, etc. relationship among different parameters, series and parallel connections of two-port networks, conditions for symmetrical and reciprocal networks, duality.

**Resonance and magnetically coupled circuits:** Introduction to resonance, series resonance, parallel resonance, concept of self-inductance and mutual inductance, coupling coefficient, magnetically coupled circuits, simple series and parallel circuits, dot convention, ideal transformer.

<u>Unit-III</u> 12 hrs

**Transient and steady state analysis**: Transients in RL, RC circuits, initial conditions, time constants, concept of phasors, impedance and admittance, analysis of RL, RC and RLC circuits with sinusoidal and driving sources, steady state analysis using phasor, network function: one-port networks and two-port networks, impedance function and admittance function, transfer function, poles and zeros of network functions, restrictions on locations of poles and zeros in driving point functions and transfer functions, review of Laplace transform, solution of network equations using Laplace transform.

Department of Electronics & Communication



Unit-IV 12 hrs

**Network synthesis**: Hurwitz polynomials, positive real functions, synthesis of dissipative networks, Foster and Cauer realization (I, II forms) for LC, RL and RC networks.

**Graph theory:** Concept of network graph, tree, tree branches and links, tie-set and cut-set matrices, introduction to SPICE simulators and MATLAB for solving circuit problems.

RECOMMENDED BOOKS		
Title	Author	Publisher
1. Fundamentals of Electric Circuits	Charles K. Alexander and Matthew N.O. Sadiku	Tata McGraw Hill
2. Engineering Circuit Analysis	William H. Hayt and Jack Kemmerly	Tata McGraw Hill
3. Network Analysis	Van Valkenburg	Prentice Hall of India
4. Circuit and Networks: Analysis and Synthesis	A.Sudhakar and S.Palli	Tata McGraw Hill
5. Networks and Systems	D. Roy Choudhary	New Age International



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	program						• • • • • • • • • • • • • • • • • • • •	50001	•5 01	11101	• • • • • • • • • • • • • • • • • • • •	P	3,5001111	, 6,51118
Course						and co	mhin	ationa	1 syste	ms				
	1. Analyse and design sequential and combinational systems.  2. Assess the performance of a given digital circuit with Mealy and Moore configuration  3. Perform static timing analysis of the digital circuits/systems.											rations		
Outcomes												tanons.		
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603		2	2	4	1	4	2	4	1	_	2	-	_	
CO2	3	3	2	1	1	1	2	1	1	0	3	2	3	2
CO3	3	3	3	3	2	2	2	1	1	0	3	2	3	3
CO4	3	3	3	1	3	2	2	1	1	0	3	2	2	3
<u> </u>			[]n	it-I		1		1	1					12 hrs

**Basics of Digital System:** Review of number system, Boolean expressions and their minimization using K-map, logic gates, Combinational circuits: Ripple carry adder, BCD, High speed adder, Subtractor, Code conversion, Magnitude comparators, Applications of Encoders, Decoders, MUX, DEMUX, Implementations using ROM, PLA, PAL. Standard ICs and their applications. Using combinational modules to design digital systems

<u>Unit-II</u> 16 hrs

Sequential Circuits: Various types of latches and flip-flops and their conversions, Universal Shift Registers, Counters – Ring, Johnson, Design of synchronous and Asynchronous Counters, Timing issues, Setup and hold times, operating frequency limitations, Static Timing Analysis, Standard ICs for their applications, Finite State Machines – Moore and Mealy, Design of Synchronous and Asynchronous sequential circuits, Races and hazards, hazard free design.

Unit-III 12 hrs

**Introduction to VHDL**: Overview of digital system design with VHDL, basic language elements, data objects, classes and data types, operators, overloading, logical operators, VHDL representation of digital design entity and architectural declarations, introduction to behavioural, dataflow and structural models, applications of VHDL to design.

Unit-IV 8 hr

**Digital logic families**: Characteristics of digital circuits: fan in, fan-out, power dissipation, propagation delay, noise margin, transistor-transistor logic (TTL), types of TTL gates, tristate logic & its applications, emitter coupled logic (ECL), CMOS, comparison of characteristics of TTL, ECL, and CMOS, interfacing of logic families.

**Semiconductor memories**: Memory organization, ROM, PROM, EPROM, EEPROM, RAM, Static RAM, Dynamic RAM cell, memory cell, reading & writing operation in RAM.

Department of Electronics & Communication



RECOMM	ENDED BOOKS	
Title	Author	Publisher
1. An Engineering Approach to Digital	Fletcher William, I	3 <sup>rd</sup> Indian reprint, PHI,
Design		(1994).
2. Digital Design	Morris Mano M	3 <sup>rd</sup> Edition, Pearson
		Education (2002).
3. VHDL-Analysis and Modeling of Digital	Navabi Z	McGraw Hill.
Systems		
4. Fundamentals of Logic Design	Charles H. Roth Jr	4 <sup>th</sup> Edition, Jaico Publishers
		(2002).
5. VHDL for Programmable Logic	Skahill Kevin	1 <sup>st</sup> Indian Reprint, Pearson
		Education (2004).
6. Verilog HDL: A Guide to Digital Design	Samir Palnitkar	2 <sup>nd</sup> Edition, Prentice Hall
and Synthesis		PTR



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CO2	3	2	2	2	3	1	1	1	1	0	0	2	3	3
CO3	3	2	2	2	3	1	1	1	1	0	0	2	3	2
CO4	3	3	2	2	2	1	1	1	1	0	0	2	3	2

**Introduction**: Definition of signals and systems, elementary signals, classification of signals and systems, properties of systems.

**LTI systems:** Continuous-time and Discrete-time LTI systems, their properties.

**Unit-I** 

Unit-II 12hrs

**Fourier series representation of signals**: Fourier series representation of continuous-time and discrete-time periodic signals, properties of continuous-time and discrete-time Fourier series.

**Fourier transform**: Continuous-time Fourier transform of periodic and aperiodic signals, properties of continuous-time Fourier transform, discrete-time Fourier transform of periodic and aperiodic signals, convolution.

Unit-III 12 hrs

**Laplace transform (LT)**: One-sided Laplace transform (LT) of common signals, important theorems, and properties of LT.

**Inverse Laplace transform**: Inverse LT, solutions of differential equations using LT, bilateral LT, region of convergence (ROC).

Unit-IV 12 hr

**Random signal theory**: Concept of probability, random variables, commutative distribution function, probability density function (PDF), average value and variance of random variables, Gaussian (PDF),

Department of Electronics & Communication

Page 18

12 hrs



Rayleigh (PDF), mean, variance and PDF of the sum of random variables, correlation between two random variables.

**Random processes**: Introduction, classification, correlation, and auto correlation, stationary andergodic process.

REC	OMMENDED BOOKS						
Title	Author	Publisher					
1. Signals and Systems	Alan V. Oppenheim, Alan S. Willsky	Pearson Education Limited, (2013)					
2. Signal Processing and Linear Systems	B P Lathi	Oxford University Press, (2003)					
3. Signals and Systems	T. Rawat	Oxford University Press, (2010)					
4. Signals and Systems	Simon Haykin, Barry Van Veen	John Wiley & Sons, (2007)					



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Outcomes ma	aterials an	nd their	r prope	erties.							
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CO2 3 3 2	2 3	1	1	2	1	1	0	0	2	3	2
CO3 3 3 2	2 3	1	1	2	1	1	0	0	2	3	2
CO4 3 3 1		1	1	2	1	1	^		-		_
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**Semiconductor physics**: The energy band theory in crystal, charge carriers in semiconductors, carrier concentrations, Fermi level, electron and hole concentration at equilibrium, carrier drift and diffusion, conductivity and mobility, carrier lifetime, Poisson's and continuity equation, Hall effect.

> **Unit-II 12 hrs**

The P-N junction theory: P-N junction equilibrium condition, contact potential, equilibrium Fermi level, electric field, space charge at junction, qualitative theory of P-N junction, P-N junction as a diode, diode equation, volt- ampere characteristics, temperature dependence of V-I characteristic, diode models, depletion and diffusion capacitance, junction breakdown mechanism, diode switching characteristics.

Special purpose devices: Varactor diode, Tunnel diode, Schottky barrier diode, LED, photodiode, **Unit-III** 

Bipolar junction transistor (BJT): Device structure and physical operation, transistor current components, modes of operation, common emitter, common base and common collector configurations, input, output characteristics, BJT specifications, DC and AC load line, transistor biasing: need for biasing, fixed bias, collector feedback bias, emitter feedback bias, collector - emitter feedback bias, voltage divider bias, bias stabilization, stability factor, stabilization against variations in V<sub>BE</sub> and β, thermal runaway, thermal stability, transistor as an amplifier, small signal low frequencyhybrid  $\pi$  model of transistor, voltage gain, power gain and current gain, expressing gain in decibels, r<sub>e</sub> transistor model, h-parameters, frequency response of BJT amplifier, switching times.

A. Marwaha

12 hrs



Unit-IV 12 hrs

**Junction field effect transistor**: Basic n channel and p channel JFET operation, its V-I characteristics.

**Metal oxide semiconductor field effect transistor**: Construction, operation and its characteristic. FET biasing, UJT.

RECO	MMENDED BOOKS						
Title	Author	Publisher					
1.Semiconductor Physics and Devices	Donald A. Neamen	Tata McGraw-Hill					
2. Electronic Devices & Circuits	J. Millman & C Halkias	McGraw Hill Education 3 <sup>rd</sup> Edition 2010					
3.Microelectronic Circuits	Adel S. Sedra, Kenneth C. Smith	Oxford Press 6 <sup>th</sup> Edition 2013					
4. Solid State Electronics Devices	Ben G Streetman & Sanjay Banerjee	PHI 6 <sup>th</sup> edition, 2013					



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<b>Obje</b>	<u>ctives</u>	desig	gning	and to	esting	of co	mbina	tional	circui	ts, sequ	uential	circuits	, digital	logic
		fami	lies an	d prog	ramm	able lo	gic de	vices.						
Cour	<u>se</u>	1.Ar	alyze	and im	pleme	nt vari	ous lo	gic gat	es and	Boolea	n functi	ions.	•	•
Outc	omes	2.De	sign a	nd ana	lyze co	ombina	ational	digital	l circui	its.				
		3.Design and analyze sequential digital circuits.												
	4.Design memories and programmable logic devices.													
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	2	1	0	1	3	2	1	2	2	3
CO2	2	3	3	3	2	1	2	1	3	2	1	2	2	3
COZ	2	3	3	3	_	_	_	_	3		_		_	3
CO3	2	3	3	3	2	3	0	1	3	2	1	2	2	3
CO4	2	1	3	3	2	3	2	1	3	2	1	2	2	3

## **List of Experiments:**

## **PART-A**

- 1. Introduction to Digital Electronics lab-nomenclature of digital ICs, specifications, study of the datasheet, concept of  $V_{cc}$  and ground.
- 2. To verify De-Morgan's Theorem and Implementation of the given Boolean function using logic gates in both SOP and POS forms.
- 3. To realize half/full adder and half/full subtractor using basic/universal gates.
- 4. To realize parallel adder/subtractor using IC 7483.
- 5. To verify BCD to excess-3 code conversion using NAND gates.
- 6. To convert Gray code to binary number and binary number to Gray code.
- 7. Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates. To implement the arithmetic circuits half adder, half subtractor, full adder and full subtractor using multiplexers.
- 8. To design and verify the operation of magnitude comparator.
- 9. Verification of state tables of RS, J-K, T and D Flip-Flops using NAND Gates with timing diagrams.

\*Experimentation work to be supported by simulated results



#### **PART-B**

- 1. To design and implement a circuit for a 2 bit parallel adder using NAND gates only.
- 2. To design and implement the 4-bit synchronous counter.
- 3. To design and implement the 4-bit asynchronous counter.
- 4. VHDL code for Half/Full adder.
- 5. VHDL behavioral description of 4-bit ALU. The circuit performs two arithmetic and two logical operations that are selected by 2-bit input. The four operations are ADD, SUB, AND and OR.
- 6. VHDL program to count number of one's in 10-bit binary number.
- 7. VHDL code for 8:3 encoder.
- 8. VHDL code for positive edge triggered T-flip flop.
- 9. VHDL code for 8-bit SISO shift register.
- \*Experimentation work to be supported by simulated results



Analog Communication   L T P Credits   3 0 0 0 3   Sessional Marks   50	
3   0   0   3	
Sessional Marks   50	
Course	
Course ObjectivesThe course emphasizes on the use of essential analytical tools and theories of a communication systems, understand various analog communication techniques, FM transmission and reception circuits, analog pulse modulation techniques noise in communication systems.Course Outcomes1. Gain knowledge about the fundamental concepts of various at communication systems.2. Design the AM, SSB, FM and PM transmission and reception circuits. 3. Analyze the performance of amplitude and frequency modulated systems design of PAM, PWM and PPM systems.	
Course Outcomes	AM,
Outcomes  communication systems.  Design the AM, SSB, FM and PM transmission and reception circuits.  Analyze the performance of amplitude and frequency modulated systems design of PAM, PWM and PPM systems.	nalog
<ol> <li>Design the AM, SSB, FM and PM transmission and reception circuits.</li> <li>Analyze the performance of amplitude and frequency modulated system design of PAM, PWM and PPM systems.</li> </ol>	iui o g
3. Analyze the performance of amplitude and frequency modulated system design of PAM, PWM and PPM systems.	
design of PAM, PWM and PPM systems.	s and
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communication system parameters including noise.	
Mapping of Course Outcomes with Program Outcomes	
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CO2 3 3 3 3 2 2 2 1 0 0 2 2 3	3
	3
CO3         3         1         1         2         2         2         1         0         0         0         2         3	
CO4         3         3         3         2         2         2         1         0         0         0         2         3	3
<u>Unit-I</u> 1	3

**Analog modulation techniques**: Introduction to modulation, need of modulation, theory of amplitude modulation, frequency spectrum of AM wave, AM power calculations, AM modulation with a complex wave, concepts of angle modulation, theory of frequency modulation, mathematical analysis of FM, spectra of FM signals, narrow band FM, wide band FM, phase modulation, phase modulation obtained from frequency modulation, comparison of AM, FM and PM.

**AM transmission**: Basic principle of AM generation, square law modulation, low level and high-level modulation, grid modulated class-C amplifier circuit (Vander Bijl modulation), plate modulated class-C amplifier circuit, suppressed carrier AM generation (balanced modulator) diode ring modulator, product modulator.

Unit-II 12 hrs

**FM transmission**: FM generation methods: generation of FM by direct method, basic reactance modulator, varactor diode modulator, indirect generation of FM by Armstrong method; frequency stabilized AFC transmitter system, pre-emphasis circuit, stereophonic FM transmitter system.

**SSB transmission**: Introduction, advantages of SSB transmission, generation of SSB, filter method, phase shift method, Hilbert transform, representing SSB signals in terms of Hilbert transforms, SSB modulator using a Hilbert transform, third method, forms of amplitude modulation, pilot carrier system, independent sideband system (ISB), vestigial sideband system (VSB).



Unit-III 12 hrs

**AM reception:** Tuned radio frequency (TRF) receiver, super-heterodyne receiver, AM receiver characteristics. RF amplifier, Image frequency rejection, choice of intermediate frequency, frequency conversion and mixer circuits, tracking and alignment, IF amplifier, AM detector, practical diode detector with AGC, distortion in diode detectors, double heterodyne receiver, coherent AM detection, AM receiver using a phase locked loop (PLL).

**FM reception**: Introduction, block diagram of FM receiver, amplitude limiter, de-emphasis circuit, basic principle of FM detection, slope detector, balanced slope detector, Foster-Seely phase discriminator, ratio detector, FM detector using PLL, zero crossing detector as a frequency demodulator, stereo FM receiver.

**SSB reception:** SSB product demodulator, balanced modulator as SSB demodulator, SSB envelop detection receiver, pilot carrier SSB receiver, SSB double heterodyne receiver, ISB receiver, modern communication receiver.

Unit-IV 12 hrs

**Analog pulse modulation techniques**: Introduction, pulse amplitude modulation (PAM), natural PAM, flat-top PAM, sampling theorem, frequency spectra for PAM, PAM time multiplexing, pulse time modulation (PTM), pulse width modulation (PWM), pulse position modulation (PPM), pulse code modulation, generation and detection of PAM, PWM, PPM and PCM.

**Noise**: Introduction, external noise, internal noise, resistor noise, multiple resistor noise sources, shot noise, transit time noise, noise in reactive circuits, noise temperature, noise bandwidth, effective input noise temperature, noise figure, noise figure calculations, noise in analog modulated systems, SNR calculation for AM and FM.

RECON	MENDED BOOKS	
Title	Author	Publisher
1. Electronic Communication Systems	Kennedy, G.	Tata McGraw-Hill (2008) 4 <sup>th</sup> ed
2. Communication Systems	Haykin, S.	John Wiley & Sons (2009) 4 <sup>th</sup> ed.
3. Principles of Communication Systems	Taub, H&Schilling	John Wiley & Sons
4. Electronic Communication Systems	Wayne Tomasi	Pearson Education (2011), 5 <sup>th</sup> ed



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Cour	<u>se</u>	To st	udy th	e trans	sistor b	ehavio	our at lo	ow and	l high f	frequen	cy and	analyze	the beh	aviour
<u>Obje</u>	<u>ctives</u>	of m	ultista	ge am	plifier	by co	upling	in dif	ferent	ways.	To stud	dy diffe	rent fee	edback
		confi	guratio	ons, os	cillato	rs, pov	ver am	plifiers	and tu	ined an	plifiers	·.		
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Outc	<u>omes</u>	2. De	2. Design transistor single stage, multistage amplifiers and tuned amplifiers.											
		3. De	esign n	nultista	age am	plifiers	s and v	arious	coupli	ng tech	niques.			
		4. De	esign a	nd ana	lyze fe	edbacl	k circu	its and	oscilla	ators.	-			
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CO1	3	3	3	2	1	2	2	1	0	0	2	2	3	2
CO2	3	3	3	2	1	2	0	1	0	0	0	2	1	2
CO3	3	3	2	3	1	2	2	1	0	0	1	2	3	2
CO4	3	3	2	2	1	2	1	1	0	0	1	2	3	2
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**Single stage BJT amplifiers**: Analysis of transistor amplifier circuit using h-parameters, CE amplifier, CB amplifier, emitter follower and comparison.

**Single stage MOS amplifiers:** Small signal operation and model, CS amplifier, CG amplifier and source follower and comparison. BJT current mirrors and MOS current mirrors circuits and their analyses.

Unit-II 12 hrs

**Multistage amplifier**: Multi-stage amplifier gain, effect of loading, types of coupling, direct and RC coupled amplifiers, frequency response of a BJT and FET amplifier, cut-off frequencies and bandwidth, cascode amplifiers- MOS cascode, BJT cascode, cascode current source, double cascoding, folded cascode, Darlington amplifier.

**Transistor at high frequencies**: High frequency model of BJT and frequency response of CE amplifier, gain-bandwidth product, Miller's theorem, MOSFET at high frequency, common source amplifier at high frequencies, analysis using Miller theorem.

Unit-III 12 hrs

**Feedback amplifiers**: Properties of negative feedback, four basic feedback topologies, analysis of current-series, current-shunt, voltage-series and voltage-shunt feedback amplifiers.

**Oscillators**- The oscillation criteria, Wien bridge, phase shift, LC tuned oscillators, crystal oscillators, astable multivibrator.



**Unit-IV** 12 hrs

Output stages and power amplifiers: Classification of output stages, analysis of class-A output stage, class-B output stage, class AB output stage, class C output stage, harmonic distortion.

Tuned amplifiers: Basic principle, inductor losses, amplifiers with multiple tuned circuits,

synchronous and stagger tuning, class C tuned a	· L						
RECOMM	ENDED BOOKS						
Title	Author	Publisher					
1.Microelectronic Circuits	Adel S. Sedra, Kenneth C. Smith	Oxford Press 6 <sup>th</sup> Edition 2013					
2. Integrated Electronics	Millman & Halkias	Tata McGraw -Hill Education					
3. Electronics devices and circuit theory	Robert L Boylestad & Louis Nashelsky	Pearson Education					



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		8085 &	z 8051.											
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	2	2	1	1	0	0	2	2	2	3
CO2	3	3	2	1	1	2	2	1	0	0	3	2	3	3
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CO3	3	3	3	3	2	2	2	1	0	0	3	2	3	3
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	l		l					l						
					ι	Jnit-I						12	2hrs	

**Introduction to 8-bit microprocessor architecture:** Microprocessor architecture & its operations, memory, input / output, interfacing devices MPU.

**Programming using 8085 microprocessor**: Instruction set of 8085 microprocessor, Addressing modes, Timing diagram of the instructions (a few examples). Assembly language programming with examples, Counter and Time Delays, Stack and Subroutine,

Unit-II 12 hrs

**Interrupts**: 8085 interrupts, restart instructions, additional I/O concepts & processes.

**Parallel input/output and interfacing applications**: I/O Device Interfacing-I/O Mapped I/O and Memory Mapped I/O, Serial (using SID and SOD pins and RIM, SIM Instructions) and Parallel data transfer,

Unit-III 12 hrs

**Introduction to 8051 microcontrollers & Programming using 8051 microcontroller:** Pin description and architecture of 8051 microcontroller, arithmetic, logic and single bit instructions, addressing modes. I/O instructions, memory read/write-only instructions, stack operations, conditional and un-conditional instructions, basic programming concepts 8051 interrupts, Timer/counter programming in the 8051. Comparison of Microprocessor and Microcontroller, micro controller and embedded processors.

Unit-IV 12 hrs

# **Interfacing with External Devices:**

Introduction to 8155/8156,8255 A programmable peripheral interface, 8253/8254 programmable interval timers, 8259 a programmable interrupt controller, 8251 USART.

8051 connection to RS 232, Serial communication programming, Interfacing of 8051 microcontroller- LCD, ADC and DAC, Stepper motor.

Department of Electronics & Communication

Page 28



RECOMMENDED BOOKS											
Title	Author	Publisher									
1.Microprocessor Architecture- Programming & Applications with 8085/8080A	Ramesh S Gaonkar	5 <sup>th</sup> Edition, Penram International Publishing									
2.Introduction of Microprocessors & Microcomputers	Ram B	4 <sup>th</sup> Edition, Dhanpat Rai Publisher (P) Ltd.									
3.The 8051 Microcontroller and Embedded Systems	nd M.Mazidi, JG Maizidi	Pearson Education									
4.An introduction to Intel family of Microprocessors	James L Antonakes	3 <sup>rd</sup> Edition, Pearson Education									
4.The 8051 Microcontroller	Kenneth J. Ayala	Pearson Education									



	PCEC-524														
	Analog Electronics Circuits Lab														
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Cour	<u>rse</u>	This 1	This lab includes the analysis of analog electronic circuits using hardware kits as well as on												
<u>Obje</u>	ectives	ORC	ORCAD spice simulator. It also includes the study of response of multistage amplifiers under												
		variou	is coup	ling tecl	hniques	. Furthe	er in this	s lab stu	ident wi	ill obsei	ve the f	requen	cy resp	onse of	
		variou	ıs ampl	ifiers.											
Cour	<u>rse</u>	1. An	alyze th	ne frequ	ency re	sponse	of vario	ous couj	pling ar	nplifier	s.				
Outo	comes	2. An	. Analyze the frequency response of FET amplifier.												
		3. An	alyze th	ne class	A, B ar	nplifier	s and tu	ined vo	ltage an	nplifier	•				
		4. Des	sign va	rious fe	edback	and osc	illator o	circuits.							
			$\mathbf{M}$	lapping	g of Cou	ırse Ou	itcomes	s with I	Prograi	n Outc	omes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	3	2	3	2	1	1	3	2	1	2	2	1	
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CO2	3	3	3 2 2 3 2 1 1 3 2 1 2 2 2												
CO3	3	2	2 3 1 2 1 1 3 2 1 1												
CO4	3	2	2 3 2 2 1 1 3 2 1 2												

### **List of Experiments:**

Note: Experiments based upon hardware using hardware kits and rest using simulation with the help of simulation packages

- 1. To measure the h-parameters of CE configuration.
- 2. To determine the voltage gain of a two stage RC coupled amplifier.
- 3. To plot frequency response characteristics of Transformer coupled amplifier.
- 4. To plot frequency response characteristics of direct coupled amplifier.
- 5. To study the gain and frequency response of CS FET amplifier.
- 6. To plot frequency response of a tuned voltage amplifier and to calculate its resonant frequency.
- 7. To study the double ended tuned amplifier.
- 8. To study the class A power amplifier and find its efficiency.
- 9. To study the class B power amplifier and find its efficiency.
- 10. To study the cascode amplifier.
- 11. To study the concept of feedback in voltage amplifier.
- 12. To study the RC phase shift oscillator and measure its frequency of operation.
- 13. To study the LC oscillator and measure the frequency of operation.
- 14. To plot the frequency response of a Darlington amplifier. Calculate gain and bandwidth.
- \*Compare the results of each aim of experiment with ORCAD spice simulation.



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	Microprocessor & Microcontroller Lab															
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Objec	ctives	device	es. It	include	es vari	ous p	rogram	s to p	erform	n speci	fic task	ks i.e. a	ddition,	sorting,		
	_	multip	ultiplication and many more. Students will be interface microprocessor 8085 kit to various													
		periph	ripheral devices such as RS-232C, 8155/8255.													
Cours	<u>se</u>	1. Pe	Perform various arithmetic and sorting operations with the help of microprocessor.													
Outco																
		3. Int														
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			-	_			tion and	d interf	ace ext	ternal d	evices v	with 8085	5 and 80:	51		
		-I	•								utcome					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO1	3	3	3	2	2	2	0	1	3	2	1	2	3	3		
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CO4	3	3	2	3	2	2	1	1	3	2	1	2	3	3		

# **List of Experiments:**

#### **PART-A**

- 1. 2's compliment of 8-bit number.
- 2. 2's compliment of 16-bit number.
- 3. Program to shift a block of data from one memory location to another.
- 4. Multiplication by two, employing bit rotation.
- 5. Addition of two 16-bit numbers.
- 6. Interface ADC chip with microprocessor kit and verify its operation.
- 7. Interface DAC chip with microprocessor kit and verify its operation.
- 8. Interface an external 8253/8254 to the microprocessor kit at the address given. Hence,
  - a) generate a pulse train of specified duty cycle at the given output line,
  - b) operate as a: N counter,
  - c) Count a train of pulses for a given duration.
- 9. Interface seven segment display through 8279.
- 10. Use the SOD line to generate a square wave of the specified duty cycle at a given frequency.



#### **PART-B**

- 1. Write a program to toggle all the bits of port 1 by sending to it the values 55H and AAH continuously. Put a time delay in between each issuing of data to port 1.
- 2. Multiply 25 by 10 using the technique of repeated addition.
- 3. Write a program to add the first 10 natural numbers.
- 4. Write a program to add two BCD numbers.
- 5. Write a program to perform the subtraction of two numbers.
- 6. Write a program to perform the division of two numbers.
- 7. Write a program using 8051 to split a byte into two nibbles and show results.
- 8. Create a square wave that has a high portion of 1085  $\mu$ S and a low portion of 15  $\mu$ S. Assume XTAL = 11.0592 MHz Use Timer 1.
- 9. Write the following programs:
  - a) Create a square wave of 50% duty cycle on bit 0 of port 1.
  - b) Create a square wave of 66% duty cycle on bit 3 of port 1.
- 10. Assuming XTAL =22 MHz, write a program to generate a pulse train of 2 seconds period on pin P2.4. Use Timer 1 in mode 1.
- 11. Design a counter for counting the pulse of an input signal. The pulse to be counted is fed to pin3.4. XTAL = 22MHz.
- 12. Design a circuit to interface ADC with microcontroller.
- 13. Design a circuit to interface DAC with microcontroller.
- 14. Design a circuit to interface LCD with microcontroller.
- 15. Design a circuit to interface keyboard with microcontroller.



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Cour	se	The n	nain ob	jective	of ind	ustrial	trainin	g is to	familia	rized st	udents v	with ind	ıstrial w	orking	
<b>Object</b>	<u>ctives</u>							_				g a holis		_	
			to understand various practical issues and latest trends in the field. The students will be												
			able to troubleshoot various engineering faults related to their respective fields. They will												
		be ab	e able to learn ethical management practices.												
Cour	<u>se</u>	1	after successful completion of industrial training, the students should be able to												
Outco	<u>omes</u>		1: implement the technical skills as an individual and in team.												
			2: correlate the theoretical concepts with the real-life industrial environment.												
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CO1	3	2	2	2	2	2	2	3	3	3	1	3	3	1	
CO2	3	2	3	3	3	3	3	2	2	3	1	3	3	1	
CO3	3	3	3 2 3 2 2 2 1 3 1 3 3												
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	PCEC-611 Digital Communication													
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The main objective of the course is to understand the fundamentals of digital communication system, the advantages over analog communication system and provide in-depth knowledge of digital modulation schemes. It emphasizes on performance analysis of digital communication system in the presence of noise, calculating the probability of error for matched filter Receiver and various digital modulation techniques.  Course Outcomes  1. Understand the theoretical aspects of digital communication system useful for today's multidisciplinary applications.  2. Gain knowledge about various data formats for digital data transmission.  3. Analyze the generation and detection of various digital modulation schemes.  4. Compare the performance of different types of digital pulse and band pass modulation techniques in terms of error rate and spectral efficiency.  5. Calculate probability of error for matched filter receiver to analyze the													and to on the ise, by	
		pe										of nois	e.	
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CO2	3	2	2	3	3	2	1	1	1	0	1	2	3	3
CO3	1	2	1	2	1	2	1	1	0	1	1	1	3	3
CO4	3	3	2	2	3	2	1	1	1	0	1	2	3	3
CO5	CO5         3         3         2         2         2         0         1         1         0         2         2         3         3												3	
	<u>Unit-I</u> 12 hrs										1			

**Elements of digital communication system**: Block diagram of digital communication system, digital representation of analog signals, advantages and disadvantages of digital communication system, noisy communication channels, information and entropy.

**Pulse code modulation:** Sampling theorem for baseband and band pass signals, aliasing, signal recovery through holding, quantization of signals, quantization error, uniform and non-uniform quantization, dynamic range, A-law and  $\mu$ -law companding, pulse code modulation (PCM), differential pulse code modulation (DPCM), need of predictor, delta modulation (DM), adaptive delta modulation (ADM), comparison of PCM, DPCM and DM.

<u>Unit-II</u> 12 hrs

**Line coding schemes**: Power spectral density (PSD) of sequence of random pulses, power spectral density of digital data, introduction to line codes and its properties, unipolar, polar and bipolar signalling formats, NRZ& RZ modulation formats, ON-OFF signalling, AMI and Manchester coding and their power spectra, comparison among various line codes, pulse shaping.



<u>Unit-III</u> 12 hrs

**Digital modulation techniques:** Digital modulation formats, binary amplitude shift keying (BASK) modulator, coherent and non-coherent ASK detection, binary phase shift keying (BPSK) transmitter, coherent BPSK detection, differential PSK, quadrature phase shift keying modulation (QPSK) transmitter and receiver, offset QPSK, M-ary BPSK, quadrature amplitude modulation (QAM), binary frequency shift keying (BFSK) transmitter, non-coherent FSK detector, coherent FSK detector, M-ary FSK, minimum shift keying (MSK) and Gaussian minimum shift keying (GMSK), power spectral analysis and comparison of signal constellations for digital modulation techniques.

<u>Unit-IV</u> 12 hrs

**Optimal reception of digital signal:** Introduction, baseband signal receiver, probability of error for the baseband signal, optimum receiver for baseband and bandpass signals, optimum filter transfer function, matched filter and its probability of error, coherent system of signal reception (correlation receiver).

**Error calculations for digital modulation techniques:** Probability of error for BPSK, effect of imperfect phase synchronization and imperfect bit synchronization on probability of error in AWGN channel, probability of error calculations for QPSK, QASK and FSK schemes, use of signal space for calculation of error probability, relationship between bit error rate (BER) and symbol error rate (SER).

	RECOMMENDED BOOKS											
Title	Author	Publisher										
1. Principles of	Goutam Saha, Herbert	Tata McGraw Hill Education Private										
Communication Systems	Taub, Donald Schilling	Limited, 3rd Edition, 2008										
2. Communication Systems	Simon Haykin, Michael	John Wiley & Sons Publication, 5th										
	Moher	Edition, 2009										
3. Digital Communications	Bernard Sklar	Pearson Education Limited, 2014										
4. Modern Analog and Digital	Bhagwandas Pannalal	Oxford University Press, 2010										
Communication	Lathi, Zhi Ding											
5. Digital Communication	John G. Proakis, Masoud	McGraw-Hill, 2008										
System	Salehi											



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Object	tives		-				_			_			-	
Cours														
Outco	_				•				•	_		_		
		<ul><li>2. Interpret and apply Maxwell's equations to analyze EM waves.</li><li>3. Understand basic concepts of electromagnetic waves transmis</li></ul>												
	conductors and dielectrics medium.													in ough
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CO2	3	3	2	1	2	2	2	1	0	2	0	1	3	3
CO3	3	1	1 1 0 2 1 1 1 0 3 2 2											
CO4	3	3	2	2	2	2	2	1	1	1	2	2	2	2
						<u>Unit-I</u>								12 hrs

**Introduction:** Review of vector theory, gradient, divergence and curl, coordinate system: rectangular, cylindrical, spherical and their transformations.

**Static electric field**: Force between point charges, Coulomb's law, electric field intensity, superposition of electric fields, electric scalar potential, charge density, gradient of potential, electric flux, electric flux density or displacement density, Gauss's law, application of Gauss's law, energy in capacitor, divergence theorem, Poisson's equation and Laplace's equation, current density, continuity equation, current and field in boundary.

Unit-II 12 hrs

**Static magnetic field:** Magnetic induction and Faraday's law, magnetic flux density, magnetic field strength, current density in a conductor, Ampere's law, Stokes's theorem, energy stored in magnetic field, force on moving charge and current element, Biot-savart law, magnetic vector potential, boundary relation in magnetic fields.

**Time varying fields:** Maxwell equation from Faraday's law, displacement current, Maxwell 's equation from Ampere's law, equation of continuity for time varying fields, Maxwell's equations in integral and differential forms for free space, conditions at boundary surface.

Unit-III 12 hrs

**Wave transmission**: EM wave in a homogeneous medium, Maxwell's equations, wave equations in free space, uniform plane wave propagation, intrinsic impedance, wave equations for conducting medium, sinusoidal time variations, conductors and dielectrics, linear, elliptical and circular polarization, reflection of plane waves at interfaces, normal and oblique incidences, reflection coefficient, Brewster angle, group velocity, phase velocity, power and energy relations, Poynting vector, waves between parallel planes, TE, TM and TEM waves.

Unit-IV 12 hrs



**Transmission lines**: Introduction, basic principles, termination of lines with load, voltage and current distribution, characteristic impedance, propagation constant, attenuation constant, phase constant, reflection coefficient, VSWR, open and short-circuited transmission lines and their impedances, stub matching, types of high frequency transmission lines, smith charts.

	RECOMMENDED BOOKS	
Title	Author	Publisher
1. Elements of Electromagnetics	M Sadiku	Oxford University Press
2. Electromagnetics	J A Edminister	Schaum's Series
3. Electromagnetics	Kraus	McGraw Hill
4. Electromagnetic Fields and Waves	K D Parsad	Parkash Publications
5. EM waves & Radiating	Jordan, Balmain	Prentice Hall
6. Electromagnetic	W H Hayt	McGraw Hill



							EEC-61									
	Linear Integrated Circuits															
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Cours	<u>se</u>	The	aim o	blocks	of line	ear inte	egrated									
<b>Objec</b>	tives	circ	uits an	p-amp	s. The	course										
		analyzes op-amps with and without feedback and determines the negative feedback														
		affects the performance of op-amps. It also includes learning of linear and non-linear														
		applications of operational amplifiers and studies various applications using 555 time														
	and PLL.															
Cours	<u>se</u>	1.	Unde	rstand	the basi	ic conc	epts an	d parai	meters	of op-a	mps.					
Outco	mes	2.	Analy	ze diff	erent o	p-amp	config	uration	s and tl	heir fre	quency	respor	ises.			
		3.	Desig	n and	analyze	e linear	and n	on-line	ar circ	uits, ac	tive filte	ers, w	ave gei	nerator		
			circui	ts and	detecto	rs.										
		4.	Expla	in Op-	amp ba	sed spe	ecialize	ed ICs.								
		•	Map	ping o	f Cour	se Out	comes	with p	rograi	n outc	omes					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO1	2	3	3	3	2	1	0	1	2	0	2	3	3	3		
CO2	3	3	3	3	2	1	0	1	1	0	0	3	3	3		
CO3	2	2	3	3	1	1	0	1	1	1	2	3	3	2		
CO4	3	3	3	3	3	1	0	1	0	0	0	3	3	3		
	L	1	I	I	<u> </u>	Unit-I	I.	1	1	1	I			12 hrs		
Introd	luction	· Intro	duction	emit			lifferen	tial an	nlifier	DC a	nd AC	analy	sis ca	scaded		

**Introduction**: Introduction, emitter coupled differential amplifier, DC and AC analysis, cascaded differential amplifier stages, level translator.

**Operational amplifiers (Op-amp):** Basic op-amp and its schematic symbol, block diagram of a typical op-amp, integrated circuits and their types, IC package types, pin identification and temperature range, overview of typical set of data sheets, characteristics and performance parameters of op-amp, equivalent circuit of an op-amp, ideal op-amp and its characteristics, ideal voltage transfer curve.

**Op-Amp parameters**: Input offset voltage, input bias current, input offset current, total output offset voltage, thermal drift, variation of op-amp parameters with supply voltage and temperature, noise, common mode configuration and common mode rejection ratio, slew rate

Unit-II 12 hr

**Op-Amp configurations and frequency response**: Open loop configurations: differential, inverting & non-inverting. negative feedback configurations: block diagram representation of feedback configurations, voltage-series feedback amplifier, voltage shunt feedback amplifier, differential amplifiers with one op-amp, two op-amps and three op-amps. frequency response, compensating networks, frequency response of internally compensated op-amps, frequency response of non-compensated op-amps, closed loop frequency response.

<u>Unit-III</u> 12 hrs

**Applications of op-amps:** DC and AC amplifiers, peaking amplifier, summing, scaling and averaging amplifier, instrumentation amplifier, V to I and I to V converter, log and antilog amplifier, integrator and differentiator.

**Active filters:** First order and second order filter, higher order low-pass filter, second order high pass filter, band pass filter, wide band-pass filter. band reject filter, all-pass filter.

Department of Electronics & Communication

Page 38



**Wave generator:** Square wave generator, triangular wave generator, saw tooth wave generator and voltage-controlled oscillator, comparator, zero crossing detector, Schmitt trigger, window detector, V to F and F to V converters, A to D and D to A converters, peak detector.

Unit-IV 12 hrs

**Specialized IC applications**: IC 555, pin configuration, block diagram, application of 555 as monostable and astable multivibrator, operating principles & applications of 565PLL.

**Voltage regulators:** Fixed voltage regulators, adjustable voltage regulators, switching regulators.

RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Op Amps & Linear Integrated circuits	Ramakant Gayakwad	Pearson Education									
2. Fundamental of Microelectronics	B Razavi	Wiley India									
3. Linear Integrated Circuits	D. Roy Choudhary	New Age International									
4. Design with Operational Amplifiers and Analog Integrated Circuits	Sergio Franco	Tata Mc-Graw Hill									



**CO4** 

							OEE	C-611	В							
	Digital Electronics															
				L			T			P			Credits	}		
				3			1			0		4				
	Sessional Marks											50				
End Semester Examination Marks													50			
Cour	The aim of this course is to introduce basic postulates of Boolean expressions are													ions and		
	ctives		analyz	nalyze the design of combinational circuits, sequential circuits, digital logic												
		families, semiconductor memories and programmable logic devices.														
Cour	<u>:se</u>		1. Uno	derstan	d vari	ous log	gic gat	es and	design	n simple	combi	national	circuits	S.		
Outc	omes		2. Des	sign an	d anal	yze se	quentia	al digit	al circ	uits.						
			3. Idea	ntify a	nd dist	inguis	h digit	al logi	c fami	lies.						
			4. Ela	borate	the c	oncept	t of se	emicor	nducto	r memo	ories an	d progr	rammab	le logic		
			devi	ces.		-										
				Mapı	oing o	f Cour	se Ou	tcome	s with	Progra	am Out	comes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO1	3	3	3	1	2	2	0	1	0	0	0	2	3	3		
CO2	3	3	3	1	2	2	2	1	0	0	0	2	3	3		
CO3	2	3	2	3 1 2 2 0 1 0 0 1 2 3 3												

**Introduction:** Representation of logic, logic variables, Boolean algebra, Boolean expressions and minimization of Boolean expression using K-map (up to six variables), review of logic gates, design and implementation of adder, subtractor, multiplexer, de-multiplexer, encoder, decoder, digital comparators, code converters.

**Unit-I** 

<u>Unit-II</u> 12 hrs

**Flip-flops**: Latches, S-R flip-flop, JK flip-flop, race around condition, master slave flip-flop, D & T type flip-flop, excitation table of flip-flops, conversion of flip-flops.

Unit-III 12 hrs

**Counters & shift registers**: Design with state equations, ripple counters, design of modulo-n ripple counter, pre-settable counters, up-down counter, decade counter, design of synchronous and asynchronous counters, design of shift registers with shift-left, shift-right & parallel load facilities, universal shift registers.

Unit-IV 12 hrs

**Digital logic families**: Characteristics of digital circuits: fan in, fan-out, power dissipation, propagation delay, noise margin, transistor-transistor logic (TTL), types of TTL gates, tristate logic & its applications, emitter coupled logic (ECL), CMOS, comparison of characteristics of TTL, ECL, and CMOS, interfacing of logic families.

**Semiconductor memories**: Memory organization, ROM, PROM, EPROM, EEPROM, RAM, Static RAM, dynamic RAM cell, memory cell, reading & writing operation in RAM.

3

12 hrs



RECOMMENDED BOOK										
Title	Author	Publisher								
1. Digital Design	Morris Mano	PHI, 4 <sup>th</sup> edition								
2. Digital System Principles & Applications	R J Tocci	РНІ								
3. Digital Integrated Electronics	Taub Schilling	Tata McGraw Hill Education								
4. Integrated Electronics	Millman & Halkias	Tata McGraw Hill Education								
5. Digital Computer Electronics	Malvino Brown	Tata McGraw Hill Education								
6. Modern Digital Electronics	R P Jain	Tata McGraw Hill								



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		End	Semes	ter Ex	amina	ation N	<b>Iarks</b>					5	0			
Cour	se	Aim	of the	course	is to s	study tł	ne basi	cs of u	ınit, di	mensior	ns and s	tandard	s. It also	gives		
	ctives					•				discusse				_		
		_	converted to digital and vice versa. It also discusses the CRO and concept of signal													
				nd ana									•	C		
Cour	Course 1. Explain various types of errors introduced in measurements.															
Outco										strumen						
		3. Understand bridge theory, working of A/D and D/A converters and their applications.														
		4. Describe the working of CRO, signal generators and analyser's and apply for														
			ureme								·	•	11 7			
			Maj	pping	of Cou	ırse O	utcom	es witl	h Prog	ram O	ıtcomes	S				
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CO2	0	3	2	1	2	2	2	1	0	0	0	2	2	1		
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CO4	0	3	2	1	2	2	2	1	0	0	1	2	2	3		
		1	l	l		Unit-I	<u> </u> :	]	]	l	<u> </u>		ı	12 hrs		

**Unit, dimensions and standards**: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, other unit systems, dimension and standards. measurement errors: gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter.

<u>Unit-II</u> 12 hrs

**Electronic Meters**: Digital voltmeter systems, digital multimeter, digital frequency meter system, voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter.

<u>Unit-III</u> 12 hrs

**Analog to digital converter**: Transfer characteristics, A/D conversion technique: simple potentiometer and servo method, successive approximation method ramp type, integrating and dual slope integrating method. D/A converter: transfer characteristic, D/A conversion technique, digital mode of operation, performance characteristics of D/A convertors.

Unit-IV 12 hrs

**CRO**: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency, and phase by CRO, oscilloscope probes, oscilloscope specifications and performance. **Signal generator, analyzer and recorders:** sine wave, non-sinusoidal signal and function generators, frequency synthesis techniques and digital signal generators, spectrum analyzer and distortion, concept of ECG, EMI, EMC, and EEG etc, X-Y recorders, plotters.



RECOMMENDED BOOKS											
Title	Author	Publisher									
Electronic Instrumentation and Measurements	David A. Bell	2nd Ed., PHI, New Delhi, 2008									
2.Electronic Measurements and instrumentation.	Oliver and Cage	TMH, 2009									



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		End So	emester	Exam	ination	Marks	8						50	
Cours	<u>e</u>	The r	nain fo	cus of	the co	ourse i	s on	underst	anding	the i	mporta	nce ar	d theories of	
Object		comm	unicatio	on syst	tems.	The st	udents	will	study	the v	arious	analo	g and	digital
		comm	communication techniques, generation, detection, transmission and reception method											
Cours	Course 1. Gain knowledge about the fundamental concepts communication systems.													
Outcomes 2. Analyse AM, SSB, FM and PM transmission and reception circuits.														
	3. Analyze the performance of amplitude and frequency modulated systems and design													esign of
		P	AM, PV	WM and	d PPM s	systems	S.							
			-		dge abo	out the	basic c	concept	s of di	gital m	odulati	on and	demod	lulation
		te	echniqu											
	1	ı			ourse o					1	1	ı	ı	
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CO1	3	2	2	2	2	2	0	1	0	2	1	2	3	3
CO2	3	3	3	3	2	2	1	1	2	2	1	2	3	3
CO3	1	1	1	0	1	2	0	1	1	1	3	2	3	3
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CO4	2	1	1	2	0	2	0	1	1	0	1	2	3	3
	<u>Unit-I</u> 1										12 hrs			

**Introduction:** Communication, information, message and signals, electromagnetic spectrum, classification of signals, periodic and non-periodic signals, analog and digital signals, deterministic and random signals, elements of a communication system, modulation and its types, need for modulation.

**Amplitude modulation:** Definition, expression of AM wave, modulation index, frequency spectrum, bandwidth, power contents of sidebands and carrier.

Unit-II 12 hrs

**Angle modulation:** Concepts of angle modulation, theory of frequency modulation, mathematical analysis of FM, spectra of FM signals, narrow band FM, wide band FM, phase modulation, phase modulation obtained from frequency modulation, comparison of AM, FM and PM.

Generation of AM and FM waves: Basic principle of AM generation, basic principle of FM generation, varactor diode modulator. DSB-SC, SSB, their comparison and areas of applications.

Unit-III 12 hrs

**Pulse modulation:** Sampling process, sampling theorem, natural sampling, flat top sampling rate, aliasing, basic idea about PAM, PWM and PPM and typical applications, reconstruction of message, pulse code modulation (PCM), block diagram of PCM system, quantization.

Department of Electronics & Communication



Unit-IV 12 hrs

**Elements of digital communication:** Block diagram of digital communication system, digital representation of analog signals, advantages and disadvantages of digital communication system,

**Digital carrier modulation techniques**: Introduction, amplitude shift keying (ASK), ASK spectrum, ASK modulator, frequency shift keying (FSK), PSK.

**Digital carrier demodulation techniques:** Coherent ASK detector, non-coherent ASK detector, non-coherent FSK detector, coherent FSK detector.

RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Communication Systems (Analog and	Sanjay Sharma	S.K. Kataria & Sons									
Digital)											
2. Electronic Communication Systems	Kennedy	Tata McGraw Hill									
3. Electronic Communications	Roddy and Coolen	Prentice Hall of India									
4. Principles of Communication Systems	Taub and Schilling	Tata McGraw Hill									



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		Sessional Marks										50			
		End	l Seme	ster E	xamina	tion N	<b>Iarks</b>						50		
Cours	se	The	main	object	ive of	this c	ourse i	s to f	amiliar	ize wit	h the	basics of	of semice	onductor	
Objec	tives	opto	electro	onics a	and vai	rious	optical	devic	es i.e.	. optica	al soui	ces, m	odulators	s, photo	
	detectors, display devices. Students will also study the modern optoelectr													_	
	systems.														
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Cours	<u>se</u>		_	_	of phys	sics to	analyz	e the fu	ındame	ental co	ncepts	of vario	us optoe	lectronic	
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CO1	2	2	3	3	2	1	2	1	0	0	2	2	2	3	
CO2	3	3	3	3	2	2	0	1	2	1	0	1	2	3	
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CO3	3	3	2	2	3	2	1	1	2	0	3	3	2	2	
CO4	3	3	3	3	2	2	2	1	2	0	3	3	2	2	
	l				]	Unit-	<u>I</u>	I	1	1	I	1		8 hrs	

**Elements of light and solid-state physics**: Wave nature of light, polarization, interference, diffraction, light source, review of quantum mechanical concept, review of solid-state physics, generic optical systems and fundamental building blocks, basics of semiconductor optoelectronics, elemental and compound semiconductor, electronic properties and optical processes in semiconductors.

<u>Unit-II</u> 14 hrs

**Optical sources and modulator**: Emission and absorption of radiation, absorption of radiation, population inversion, optical feedback, threshold conditions-laser losses, line shape function, population inversion and pumping threshold conditions, laser modes, classes of laser, single mode operation, frequency stabilization, VCSEL, mode locking, Q switching, laser applications, high power applications of lasers, LEDs electrooptic effect, electro-optic switch and modulator, Kerr modulators, MZM modulators, electro-absorption modulator..

Unit-III 14 hrs

**Photo detectors**: Principle of optical detection, detector performance parameters, thermal detectors, photon devices, solar cell.

**Display devices**: Luminescence, photoluminescence, cathode luminescence, cathode ray tube, electro luminescence, injection luminescence and light emitting diodes, plasma displays, display brightness, LCD, numeric displays.



<u>Unit-I</u>	V		12 hrs								
Optoelectronic integrated circuits: Introduction	on, hybrid and monolithic	integration, appli	cation of								
optoelectronic integrated circuits, integrated transmitters and receivers, guided wave devices.											
RECOMMENDED BOOKs											
Title Author Publisher											
1. Semiconductor Optoelectronic Devices	Pallab Bhattacharya	Pearson Educatio	n Inc								
2. Photonics - Optical Electronics in Modern Communications	A. Yariv and P. Yeh,	Oxford University	y Press								
3. Opto Electronics – As Introduction to materials and devices	Jasprit Singh	McGraw-Hill International									
4. Opto Electronics – An Introduction	J. Wilson and J. Haukes	Prentice Hall, 199	95								

Department of Electronics & Communication



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Cours	se	Th	e aim o	of this	course	is to i	ntrodu	ce the	studen	ts to th	e MA	ГLАВ	progra	mming
Objec			The aim of this course is to introduce the students to the MATLAB programs language for numerical computations and its application in engineering											
			hnolog				1			11			,	U
Cours	se			•	basic	comm	ands,	manag	e cont	ents a	nd de	velop	progra	ms in
Outco	<del></del>		MATI				ĺ	Ü					1 0	
2. Perform mathematical modeling in MATLAB.														
		3.			alyze ar		_							
		4.	Utilize	progr	amming	g skills	to enh	ance le	earning	and pe	rforma	nce in	engine	ering.
		•			Course									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	1	1	2	1	2	3	2	2
CO2	2	3	3	3	3	2	1	1	2	1	1	2	2	3
CO3	3	3	3	3	3	0	0	1	3	2	2	3	1	2
CO4	3	2	2	3	3	1	0	1	3	2	2	3	3	2
						Unit-I								12 hrs
Intera	ctive c	omput	ation:	Basics	of MA		MAT	LAB	vindow	s inpu	t-outni	ıt file	types	

**Interactive computation:** Basics of MATLAB, MATLAB windows, input-output, file types, general commands, working with arrays of numbers, creating and plotting simple plots, creating, saving and executing script and function files, language specific features, and advanced data objects.

Unit-II 12 hrs

**Matrices and vectors manipulation:** Matrices and vectors input, indexing, matrix manipulation, creating vectors, matrix and array operations, arithmetic operations, relational operations, logical operations, elementary math functions, matrix functions and character strings.

Unit-III 12 hrs

**Linear algebra, interpolation and data analysis:** Solving a linear system, Gaussian elimination, finding eigen values & eigenvectors, matrix factorization, polynomial curve fitting, least squares curve fitting, interpolation, data analysis and statistics, MATLAB applications in linear algebra, curve fitting and interpolation, data analysis and statistics.

<u>Unit-IV</u> 12 hrs

**Graphics manipulation:** Basic 2-D plots, style options, labels, title, legend, and other text objects, axis control, zoom-in and zoom-out, modifying plots, overlay plots, specialized 2-D plots and introduction to 3-D plots.

# RECOMMENDED BOOKS

Title	Author	Publisher
1. Getting Started with MATLAB	Rudra Pratap,	Oxford University Press
2. MATLAB Programming	Y. Kirani Singh, B. B. Chaudhuri	PHI
3. MATLAB and Its Applications	Raj Kumar Bansal	Pearson Education India
in Engineering		
4. MATLAB by Example	Abhishek Kr Gupta,	Finch Publications

Department of Electronics & Communication



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Cours	<u>e</u>	The	course	descri	bes vai	rious li	near wa	ave sha	ping ci	rcuits,	switchi	ng char	acteris	stics of
Objec	tives	dio	de, trar	isistor	and no	n-linea	ır wave	shapi	ng circ	uits. T	he desi	gn of	multiv	ibrator
		l l						-	_	locking		_		
		des	ign ope	ration	of time	base c	ircuits	is also	explair	ned.				
Cours	design operation of time base circuits is also explained.  Lourse  1. Acquire knowledge of wave shaping circuits and switching characteristics of diode													
	Outcomes and transistors.													
	2. Analyze different types of multivibrator and their design procedures.													
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CO2	3	3	3	3	2	2	0	1	0	2	1	1	3	2
соз	2	1	1	2	1	0	0	1	2	1	0	0	2	3
CO4	3	3	3	3	3	2	1	1	0	2	1	1	2	3
	1	I	I		U	nit-I	1	1	1	ı	1	1	1	12 Hrs
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**Linear wave shaping**: High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square, ramp and exponential inputs, high pass RC circuit as differentiator and low pass RC circuit as integrator, attenuators, RL and RLC circuits and their response for step input, ringing circuit.

**Non-linear wave shaping**: Diode clippers, transistor clippers, clipping at two independent levels, emitter coupled clipper, diode comparators, applications of voltage comparators, clamping operation, clamping circuits using diode with different inputs, clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage.

Unit-II 12 Hrs

**Switching characteristics of devices**: Diode as a switch, diode switching times, temperature variation of saturation parameters, design of transistor as a switch, transistor switching times, transistor in saturation.

**Bistable multivibrators**: Stable states of a bistable multivibrator, design and analysis of fixed bias and self-biased bistable multivibrator, direct connected binary circuit, Schmitt trigger circuit using transistors, emitter coupled bistable multivibrator.

<u>Unit-III</u> 12 Hrs

**Monostable and astable multivibrators**: Monostable multivibrator, design and analysis of collector coupled, and emitter coupled monostable multivibrator, triggering of monostable multivibrator, astable multivibrator, collector coupled and emitter coupled astable multivibrator.



Unit-IV 12 Hrs

**Time base generators**: General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators – basic principles, transistor Miller time base generator, transistor Bootstrap time base generator, current time base generators, methods of linearity improvements.

**Blocking oscillator circuits**: Triggered transistor blocking oscillator, an astable transistor blocking oscillator, applications of blocking oscillators.

RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Pulse, Digital and Switching Waveforms 3rd Edition, 2008.	Millman and Taub	Tata McGraw-Hill									
2.Microelectronic Circuits, 7th Edition 2014	Sedra and Smith	Oxford University Press									
3. Pulse and Digital Circuits, 2006	Motheki S. Prakash Rao	Tata McGraw-Hill									
4. Fundamental of Microelectronics, 2nd Edition 2009	B.Razavi	John-Wiley									



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							MEMS	<u> </u>						
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		Sessi	onal M	[arks									50	
		End	Semest	er Exa	minati	on Ma	rks						50	
Cours	<u>e</u>	The	course	aims to	give	the stu	dents a	basic	knowle	edge al	out sta	ite-of-t	he-art 1	MEMS
Object	tives	inclu	ding te	chnolog	gy, dev	ice arc	hitectu	re, des	ign and	d mode	lling, s	calabili	ity, fig	ures of
merit and RF IC novel functionality and performance. Reliability and packaging a												re also		
		considered as key issues for industrial applications.												
Cours	Course 1. To gain basic knowledge about MEMS and its various micro system products.													
Outco	mes	2. Stu	ident w	ill acqu	iire kno	wledge	e about	differe	ent facto	ors and	proper	ties of 1	materia	ls used
		in de	in design of MEMS.											
		3. To	unders	tand ba	sic ide	a fluid	mechar	nics in	micro a	nd mad	ro scal	es.		
		4. To	attain l	knowle	dge abo	out vari	ious lev	els of j	packagi	ing of n	nicrosy	stems.		
		I	Mappir	ng of C	ourse (	Outcon	nes wit	h prog	ram ou	ıtcome	S			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	2	2	1	3	2	1	2	2	1
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CO2	2	2	2	2	1	0	1	1	3	2	1	2	2	2
CO3	3	3	3 1 1 0 0 3 1 3 2 1 2 1 1											
CO4	2	2	1	2	1	0	1	1	3	2	1	2	2	2
	<u>Unit-I</u>										12 hrs			

**MEMS and microsystems**: MEMS and micro system products, evaluation of micro fabrication, Microsystems and microelectronics, applications of microsystems, working principles of Microsystems, micro actuators, micro actuators, MEMS and micro actuators, micro accelerometers.

**Scaling laws in miniaturization:** Introduction, scaling in geometry, scaling in rigid body dynamics, the trimmer force scaling vector, scaling in electrostatic forces, electromagnetic forces, scaling in electricity and fluidic dynamics, scaling in heat conducting and heat convection.

Unit-II 12 hrs

**Materials for MEMS and microsystems**: Substrates and wafers, silicon as a substrate material, ideal substrates for MEMS, single crystal Silicon and wafers crystal structure, mechanical properties of Si, Silicon compounds; SiO<sub>2</sub>, SiC, Si<sub>3</sub>N<sub>4</sub> and polycrystalline silicon, silicon piezo-resistors, gallium arsenide, quartz, piezoelectric crystals, polymers for MEMS, conductive polymers.

Engineering mechanics for microsystems design: Introduction, static bending of thin plates, circular plates with edge fixed, rectangular plate with all edges fixed and square plates with all edges fixed. Mechanical vibration, resonant vibration, micro accelerometers, design theory and damping coefficients. thermo mechanics, thermal stresses. fracture mechanics, stress intensity factors, fracture toughness and interfacial fracture mechanics.

Unit-III 12 hrs

Basics of fluid mechanics in macro and mesco scales: Viscosity of fluids, flow patterns Reynolds number. basic equation in continuum fluid dynamics, laminar fluid flow in circular conduits, computational fluid dynamics, incompressible fluid flow in micro conducts, surface tension, capillary effect and micro pumping, fluid flow in sub micrometer and nanoscale, rarefied gas, Knudsen and Mach number and modeling of micro gas flow, heat conduction in multilayered thin films, heat conduction in solids in sub micrometer scale, thermal conductivity of thin films - heat conduction equation for thin films.



Unit-IV 12 hrs

**Micro system packaging and applications of MEMS**: Micro system packaging, general considerations, the three levels of microsystems packaging, die level, device level and system level, essential packaging technologies, die preparation, surface bonding wire bonding and sealing, three-dimensional packaging, assembly of microsystems, selection of packaging materials.

The MEMS switch and its design consideration: The MEM resonator and its design considerations, micromachining-enhanced planar microwave passive elements.

RECON	RECOMMENDED BOOKS											
Title	Author	Publisher										
MEMS and Microsystems Design and Manufacture	Tai-Ran Hsu	Tata McGraw Hill										
2. Fundamentals of Micro fabrication	Mark Madou	CRC Press										
3. Micro sensors: Principles and Applications	J. W. Gardner	John Willey ,2009										
4. Semiconductor Sensors	S. M. Sze	Tata McGraw Hill										
5. An Introduction to Microelectromechanical Systems Engineering	Nadim Maluf and Kirt Williams	Artech, 2 <sup>nd</sup> Edition, 2004										
6. Introduction to Microelectromechanical Microwave Systems	Hector J. De Los Santos	Artech, 2 <sup>nd</sup> Edition, 2004										



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<b>Obje</b>	ctives	th	eory. T	The cou	rse wil	l study	how in	nformat	ion is	measure	ed in ter	ms of p	orobabil	ity and
		eı	itropy,	and the	relatio	nships	among	condit	ional a	nd joint	entropi	es; how	these a	re used
		to	calcul	late the	capaci	ity of a	a comn	nunicat	ion ch	annel, v	with an	d witho	out noise	e; how
		di	screte	channe	ls and	measu	res of	informa	ation g	eneraliz	ze to th	eir con	tinuous	forms;
		co	discrete channels and measures of information generalize to their continuous forms; complexity, compression, and efficient coding of text, and audio-visual information											
		co	oding	scheme	es; incl	uding	error	detecti	ng an	d corre	ecting o	codes,	block o	coding,
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CO2	1	0	0	0	2	0	0	1	1	0	2	2	2	2

**CO3** CO4 CO5 **Unit-I** 

**Information theory**: Concept of amount of information -units, entropy -marginal, conditional and joint entropies -relation among entropies, mutual information, information rate, channel capacity, redundancy and efficiency of channels.

**Discrete channels**: Symmetric channels, binary symmetric channel, binary erasure channel, cascaded channels, repetition of symbols, binary symmetric channel, Shannon theorem, continuous channels – capacity of band limited Gaussian channels, Shannon-Hartley theorem, trade-off between band width and signal to noise ratio, capacity of a channel with infinite band width, optimum modulation system.

Unit-II 12 hrs.

**Source coding**: Encoding techniques, purpose of encoding, instantaneous codes, construction of instantaneous codes, Kraft's inequality, coding efficiency and redundancy, noiseless coding theorem, construction of basic source codes – Shannon-Fano algorithm, Huffman coding, arithmetic coding, ZIP coding.

**Source coding, text, audio and speech**: Text: Adaptive Huffman coding, arithmetic coding, LZW algorithm audio: perceptual coding, masking techniques, psychoacoustic model, MEG audio layers I, II, Dolby AC3 speech: channel vocoder, linear predictive coding.



**Source coding, image and video**: Image and video formats – GIF, TIFF, SIF, CIF, QCIF, image compression: READ, JPEG, video compression: principles-I, B, P frames, motion estimation, motion compensation, H.261, MPEG standard.

<u>Unit-III</u> 12 hrs

Codes for error detection and correction: Parity check coding, linear block codes, error detecting and correcting capabilities, generator and parity check matrices, standard array and syndrome decoding.

Block codes: Definitions and principles: Hamming weight, Hamming distance, minimum distance decoding - single parity codes, hamming codes, repetition codes - linear block codes, cyclic codes - syndrome calculation, encoder and decoder – CRC.

Unit-IV 12 hrs.

**Convolution codes:** Code tree, trellis, state diagram, structural properties, encoding – decoding: sequential search and Viterbi algorithm – principle of turbo coding, soft-decision decoding, and Viterbi decoding algorithm.

**Advanced coding techniques and cryptography**: BCH codes, trellis coded modulation, introduction to cryptography, overview of encryption techniques, symmetric cryptography, DES, IDEA, asymmetric algorithms, RSA algorithm.

RECOM	MENDED BOOKS	
Title	Author	Publisher
1. Information Theory, Coding and Cryptography,	Ranjan Bose	Tata McGraw Hill
2. Applied Coding and Information Theory for Engineers	Richard B. Wells	Pearson
3. Coding and Information Theory,	.R. W. Hamming	Prentice Hall, 2 <sup>nd</sup> edition,
4. Information Theory and Reliable Communication,	R. G. Gallager,	Wiley
5. The Theory of Information and Coding.	R.J. McEliece	Addison –Wesley
6. Introduction to information Theory	M. Mansuripur,	Prentice Hall
7. Principles of communication	Taub & Schilling	McGraw Hill
8. Elements of Information Theory	Thomas Cover & Joy Thomas	John Wiley & Sons



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Cours	<u>e</u>	This	This lab includes hardware kits as well software simulator to analyze different analog												
<b>Objec</b>	<u>tives</u>	comm	communication systems. The main objective is to analyze the performance of AM, FM												
		modu	modulation systems in time and frequency domain, to study and design the circuits for												
		transn	ransmission and reception of AM, FM and pulse modulation systems.												
Cours	<u>e</u>	1. Des	1. Design and analyze AM and FM modulation circuits on hardware as well as on												
Outco	mes	MU	MULTISIM simulator.												
		2. Understand transmission and reception of AM and FM systems.													
		3. Des	sign and	d analy	ze vario	ous puls	se modu	ılation	systems	on har	dware a	as well	as on		
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CO2	3	3	3	3	3	2	2	1	3	2	1	3	3	2	
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CO4	3	3	3	3	3	2	0	1	3	2	1	3	3	2	

# **List of Experiments (Hardware):**

## **PART-A**

- 1. To measure the modulation index of AM signal using the sine wave method and trapezoidal
- 2. method.
- 3. To setup the circuit of AM modulator using transistor.
- 4. To setup the circuit of envelop detector for AM demodulation.
- 5. To study the DSB/SC AM signal and its demodulation using product detector circuit.
- 6. To study the generation and detection of FM signals.
- 7. To study the AM transmitter circuit and observe the waveforms at test points.
- 8. To study the FM transmitter circuit and observe the waveforms at test points.
- 9. To study the AM receiver circuit and observe the waveforms at test points.
- 10. To study the sampling process and time division multiplexing.
- 11. To study the pulse amplitude modulation and demodulation circuits.
- 12. To study the pulse width modulation and demodulation circuits.
- 13. To study the pulse code modulation and demodulation circuits.



## **Software (using MULTISIM)**

- 1. To study the spectrum of pulses using spectrum analyzer.
- 2. To measure the modulation index of AM signal using the sine wave method and trapezoidal method.
- 3. To observe the amplitude spectrum and measure the bandwidth of AM signal.
- 4. To setup the circuit of AM modulator using transistor.
- 5. To setup the circuit of envelop detector for AM demodulation.
- 6. To setup the circuit of DSB/SC AM and DSB-FC AM using product modulator/multiplier.
- 7. To study the FM wave generated from FM source in MULTISIM and measure the modulation index by approximate method.
- 8. To observe the amplitude spectrum and measure the bandwidth of FM signal.
- 9. To generate FM signal using voltage-controlled oscillator on MULTISIM and observe the waveforms on CRO.
- 10. To generate pulse amplitude modulation (PAM) signal and observe its waveform.
- 11. To generate PWM signal using 555 timer IC and observe its waveform.
- 12. To generate PPM signal and observe its waveform.

#### **PART-B**

#### **Hardware**

- 1. To study time division multiplexing system.
- 2. to study pulse code modulation and demodulation.
- 3. To study delta modulation and demodulation and observe effect of slope overload.
- 4. To study pulse data coding techniques for various formats.
- 5. To study amplitude shift keying modulator and demodulator.
- 6. To study frequency shift keying modulator and demodulator.
- 7. To study phase shift keying modulator and demodulator.

## **Software**

- 1. To generate BASK signal and observe the frequency spectrum on MULTISIM software.
- 2. To generate BPSK signal and observe the frequency spectrum on MULTISIM software.
- 3. To generate BFSK signal and observe the frequency spectrum on MULTISIM software.
- 4. To setup the model for BPSK baseband modulation for scatter plot to observe the constellation on MATLAB/SIMULINK software.
- 5. To setup the model for QPSK baseband modulation for scatter plot on to observe the constellation on MATLAB/SIMULINK software.
- 6. To setup the model for BFSK baseband modulation for scatter plot on to observe the constellation on MATLAB/SIMULINK software.
- 7. To setup the BPSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.
- 8. To setup the QPSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.
- 9. To setup the BFSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.



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The aim of this course is to introduce the basic building blocks of circuits and acquire knowledge of fundamental characteristics of operations of operational amplifiers and studies various application and PLL.    Course												op-ame e nega inear a ions u	ps. The attive feared nor sing 55	course edback n-linear 55 timer		
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CO3	2	2	3	3	1	1	1	1	1	1	2	3	3	2		
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**Introduction**: Introduction, emitter coupled differential amplifier, DC and AC analysis, cascaded differential amplifier stages, level translator.

**Operational amplifiers (Op-amp):** Basic op-amp and its schematic symbol, block diagram of a typical op-amp, integrated circuits and their types, IC package types, pin identification and temperature range, overview of typical set of data sheets, characteristics and performance parameters of op-amp, equivalent circuit of an op-amp, ideal op-amp and its characteristics, ideal voltage transfer curve.

**Op-Amp parameters**: Input offset voltage, input bias current, input offset current, total output offset voltage, thermal drift, variation of op-amp parameters with supply voltage and temperature, noise, common mode configuration and common mode rejection ratio, slew rate

Unit-II 12 hrs

**Op-Amp configurations and frequency response**: Open loop configurations: differential, inverting & non-inverting. negative feedback configurations: block diagram representation of feedback configurations, voltage-series feedback amplifier, voltage shunt feedback amplifier, differential amplifiers with one op-amp, two op-amps and three op-amps. frequency response, compensating networks, frequency response of internally compensated op-amps, frequency response of non-compensated op-amps, closed loop frequency response.

Unit-III 12 hrs

**Applications of op-amps:** DC and AC amplifiers, peaking amplifier, summing, scaling and averaging amplifier, instrumentation amplifier, V to I and I to V converter, log and antilog amplifier, integrator and differentiator.

**Active filters:** First order and second order filter, higher order low-pass filter, second order high pass filter, band pass filter, wide band-pass filter. band reject filter, all-pass filter.

Department of Electronics & Communication

Page 57



**Wave generator:** Square wave generator, triangular wave generator, saw tooth wave generator and voltage-controlled oscillator, comparator, zero crossing detector, Schmitt trigger, window detector, V to F and F to V converters, A to D and D to A converters, peak detector.

<u>Unit-IV</u> 12 hr

**Specialized IC applications**: IC 555, pin configuration, block diagram, application of 555 as monostable and astable multivibrator, operating principles & applications of 565PLL.

**Voltage regulators:** Fixed voltage regulators, adjustable voltage regulators, switching regulators.

RECOMMENDED BOOKS										
Title Author Publisher										
1.Op Amps & Linear Integrated circuits	Ramakant Gayakwad	Pearson Education								
2. Fundamental of Microelectronics	B Razavi	Wiley India								
3. Linear Integrated Circuits	D. Roy Choudhary	New Age International								
4. Design with Operational Amplifiers and Analog Integrated Circuits	Sergio Franco	Tata Mc-Graw Hill								



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Course O	) bjecti	ives 7	The aim of this course is to study the basics of cellular syste											mpart		
		k	knowledge about the fading effects. The emphasis will be to analyze diff													
			modulation techniques used for mobile communication and understand													
			concepts of CDMA and GSM wireless communication standards.													
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			2. Distinguish between different types of fading in wireless communication.													
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CO4	2	2	0	0	1	2	2	1	0	0	3	2	3	3		
	<u>Unit-I</u> 12hrs															

**Introduction to wireless communication systems**: Concept of cellular communication system, basics of wireless cellular system, mobile unit, base station, mobile switching centre, frequency reuse, channel assignment strategies, co-channel interference, determining the frequency reuse distance, hand-off strategies, interference and system capacity, trunking efficiency, improving capacity of cellular system, cell splitting and sectoring.

Unit-II 12 hrs

**Mobile radio propagation**: Introduction to radio wave propagation, free space propagation model, basic propagation mechanisms, reflection, diffraction, scattering, outdoor propagation models, indoor propagation models, signal penetration into buildings, types of small-scale fading, fading effects due to Doppler spread and delay spread, diversity techniques.

Unit-III 12 hrs

**Modulation techniques**: Introduction to linear modulation techniques, minimum shift keying, Gaussian minimum shift keying, spread spectrum modulation techniques, DS-SS, and FH-SS systems, performance of modulation schemes, power spectrum and error performance in fading channels.

Unit-IV 12 hr

**Wireless communication standards**: Introduction to GSM, GSM services and features, system architecture, radio subsystem and channel types. cellular code division multiple access (CDMA) systems: principle, power control, effects of multipath propagation on code division multiple access and introduction to third generation wireless networks, long term evolution (LTE) and standards, introduction to 5G technology.

Department of Electronics & Communication



रसम् अ	RECOMMENDED BOOK	S
Title	Author	Publisher
1.Wireless Communications	T.S Rappaport	Pearson Education, 2003.
2.Principles of Mobile Communication	Gordon L. Stuber	Springer International Ltd., 2001.
3. Wireless Communications	Andrea Goldsmith	Cambridge University Press, 2007



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Outc		2. Write basic assembly language program in 8085.															
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**Introduction:** Digital computing, computer languages, from large chip computers to single chip microcomputers, microcomputers organization, and 4-bit microprocessors.

**8-bit microprocessor architecture**: Microprocessor architecture & its operations, memory, input/output, interfacing devices MPU, 8085 based microcomputer, instruction classification, instruction format, instruction timings, 8080 a MPU, overview of 8085/8080a instruction set.

Unit-II 12 hrs

**Programming using 8085 microprocessors**: Data transfer instructions, arithmetic operations, logic operations, branch operations, programming techniques using looping counting & indexing, dynamic debugging, time delays, counters, stack, subroutines, conditional call, and return instructions, advanced subroutine concepts.

Unit-III 12 hrs

**Interrupts**: The 8080A interrupts the 8085 interrupts, restart instructions, additional I/O concepts & processes.

**Parallel input/output and interfacing applications**: Basic interfacing concepts, interfacing output displays, interfacing input keyboards, and memory mapped I/O, interfacing memory, interfacing D/A& A/D converters.

Unit-IV 12 hrs

**General purpose programmable peripheral devices**: Introduction to 8155/8156,8255 a programmable peripheral interface, 8253 programmable interval timers, 8259 a programmable interrupt controller, SID & SOD lines, 8251 USART.

**Microprocessor applications:** Temperature controller, traffic light controller, stepper motor control, comparison of 8-bit, 16-bit and 32-bit microprocessors, introduction to Pentium processors.



RECOMMENDED BOOKS											
Title	Author	Publisher									
1.Microprocessor Architecture- Programming & Applications with 8085/8080A	Ramesh S Gaonkar	5 <sup>th</sup> Edition, Penram International Publishing									
2.Introduction of Microprocessors & Microcomputers	Ram B	4 <sup>th</sup> Edition, Dhanpat Rai Publisher (P) Ltd.									
3.Microprocessor Interfacing Technique	Rodnay Zaks and Austin Lesea	1 <sup>st</sup> Indian Edition, BPB Publication									
4.An introduction to Intel family of Microprocessors	James L Antonakes	3 <sup>rd</sup> Edition, Pearson Education									
5.Microprocessor Principles and Applications	Charles M Gilmore	2 <sup>nd</sup> Edition, McGraw Hill									



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			every step of fabrication from crystal growth to photolithography to manufacturing											
				and to have a deep knowledge of fabrication process flow and learning design and										
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dioxide, silicon nitride and metal films, epitaxial growth of silicon: modeling and technology  Unit-III 12hrs														
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<b>Metal film deposition</b> : Evaporation and sputtering techniques, failure mechanisms in, metal interconnects and multi-level metallization schemes.														
Plasma and rapid thermal processing: PECVD, Plasma etching and RIE techniques, RTP techniques														
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A. Marwaha

Advance MOS technology: Introduction and latest trends in VLSI technology.



RECOMMENDED BOOKS											
	Title			Author		Publisher					
1. The Sc	eience and	Engineering	of	Stephen	A.	Oxford University Press, 2012					
Microele	ectronic Fabri	cation		Campbell							
2. VLSI Tec	chnology 2 <sup>nd</sup> e	dition		Sze		McGraw-Hill Book Company, New Delhi, 1988					
3. VLSI Fab	rication Princ	iples		Sorab K. Gan	dhi	John Wiley, 1994					



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It gives an understanding of the fundamentals of nanotechnology, gives a gene introduction to different classes of nanomaterials. Basic knowledge on various synthe and characterization techniques involved in Nanotechnology will be imparted. Stude will be familiarized with nanotechnology potential.    Course												enthesis tudents		
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CO1	2	3	3	2	1	2	1	1	0	0	1	2	2	3
CO2	2	2	2	2	1	2	1	1	3	0	1	2	1	3
CO3	2	2	2	1	2	3	3	1	2	0	1	2	2	3
CO4	2	2	2	1	1	2	2	1	1	0	0	0	1	3
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Unit-II 12 hrs

**Semiconductor nano particles synthesis**: Cluster compounds, quantum-dots from MBE and CVD, wet chemical methods, reverse micelles, electro-deposition, pyrolytic synthesis, self-assembly strategies.

**Semiconductor nano particles- size—dependent physical properties**: Melting point, solid-state phase transformations, excitons, band-gap variations-quantum confinement.

Unit-III 12 hrs

**Semiconductor nano particles–applications**: Optical luminescence and fluorescence from direct band gap semiconductor nanoparticles, surface-trap passivation in core-shell nanoparticles, carrier injection.

**Doping:** Electroluminescence, barriers to nanoparticle lasers, doping nanoparticles, Mn-Zn-Se phosphors, light emission from indirect semiconductors, light emission form Si Nanodots.

<u>Unit-IV</u> 12 hrs

**Semiconductor nanowires**: Fabrication strategies, quantum conductance effects in semiconductor nanowires, porous silicon, nanobelts, nanoribbons, nano springs.

**Physical methods:** Inert gas condensation, arc discharge, RF-plasma, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis



RECOMMENDED BOOKS								
Title	Author	Publisher						
1. Encyclopedia of Nanotechnology	Hari Singh Nalwa	Springer Inc.						
2. Springer Handbook of Nanotechnology	Bharat Bhusan	Springer Inc.						
3. Introduction to Nanotechnology	Poole Jr., C.P., Owens, F.J	Wiley Inc.						
4. A Textbook of Nanoscience and Nanotechnology	B S Murthy	Springer Inc.						



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CO1	3	2	2	2	2	1	1	1	0	0	2	3	3	3	
CO2	2	3	3	3	3	1	2	1	2	0	2	3	3	2	
CO3	2	0	0	3	3	3	3	1	1	0	1	3	3	2	
CO4	3	2	2	2	3	0	1	1	2	0	1	3	3	3	
		·		1	1	Unit-l	[	1	·	1		1		10 hrs	
Biome	edical	instrun	nentati	on: Ma	an-instr	ument	system	, physi	ologica	l syster	ns of h	uman,	transdu	cers for	

**Biomedical instrumentation**: Man-instrument system, physiological systems of human, transducers for biomedical applications, sources of bioelectric potentials, resting and action potentials, propagation of action potentials, bioelectric potential, electrode theory, bioelectric potential electrodes, biochemical transducers,

<u>Unit-II</u> 14 hrs

**Biomedical recording systems:** Basic recording system, general considerations for signal conditioners, preamplifiers, biomedical signal analysis techniques, signal processing techniques, amplifier and driver stage, writing systems, inkjet recorders, potentiometric recorders, digital recorders, electrocardiograph, vector cardiograph, phonocardiograph, electroencephalograph, electromyography, oximeters, blood flow meters, spirometry and pulmonary function measurements.

<u>Unit-III</u> 12 hrs

**Modern imaging systems:** Basics of diagnostic radiology, digital radiography, constructional and operational details of X-ray machine, X-ray computed tomography, nuclear medical imaging system, magnetic resonance imaging system, ultrasonic imaging system and thermal imaging system.



<u>Unit-IV</u> 12 hrs

**Biotelemetry**: Physiological parameters adaptable to biotelemetry, components of biotelemetry system, implantable units, applications in patient care and monitoring, wireless telemetry, single channel telemetry system, multi-channel wireless telemetry system, multi-patient telemetry, implantable telemetry system, analog physiological signal transmission over telephone lines and telemedicine.

RECOMMENDED BOOKS									
Title	Author	Publisher							
1. Biomedical Instrumentation	Leslie Cromwell, Fred J. Weibell	Pearson Prentice Hall2006							
and Measurements	and Erich A. Pfeiffer								
2. Introduction to Biomedical	Joseph J. Carr and John M.	Pearson Education India, 2001							
Equipment Technology	Brown								
3. Handbook of Biomedical	R. S. Khandpur	Tata-McGraw Hill Education,							
Instrumentation		2003							



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Cour														and its	
<u>Obje</u>	<u>ctives</u>													physical	
			modeling of electric-mechanical system, finding the transfer function using block diagram												
			reduction and signal flow graphs and analysis of steady state and transient state. To												
understand the concept of stability using various techniques such as Roccriterion, root locus technique, Nyquist, bode plots and state space analysis.											Hurwitz				
1. Understand basics of control system theory and its role in engineering design.															
Outcomes 2. Explain concept of poles and zeros of a transfer function and their effect on p										physical					
behavior of a system.															
			4. Perform state variable analysis of systems and establish relationship between state variable representation and transfer functions.												
		V								4-					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	m outc	PO11	PO12	PSO1	PSO2	
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CO1	3	2	2	3	0	0	0	1	2	0	1	2	3	3	
CO2	3	1	1	1	0	0	0	1	1	0	0	1	3	2	
CO3	3	3	2	2	0	0	0	1	0	0	0	1	3	2	
CO4	3	3	3	1	0	1	1	1	0	0	2	2	3	2	
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**OEEC-622B** 

<u>Unit-II</u> 12 hrs

System response: Time domain and frequency domain response of the first and second order systems.

time domain specifications, steady state error and coefficients, type and order of system with P, PI, PD and PID controller, relation between time and frequency response for second order systems.

Unit-III 14 hrs

**Stability analysis**: Pole-zero location and stability, Routh-Hurwitz criterion, root locus, log. magnitude versus phase angle plot, bode plots, Nyquist criterion for stability, necessity of compensation, lead, lag and lead-lag compensation networks.



Unit-IV 10 hrs

**State variable analysis**: State space representation of continuous time systems, state equations, transfer function from state variable representation, solution of state equations, controllability and observability, state space representation of discrete time systems.

RECOMMENDED BOOKS									
Title	Author	Publisher							
1. Modern Control Engineering	Ogata K	Prentice Hall, 5th Edition 2010							
2. Automatic Control Systems	Kuo BC	Prentice Hall, 9th Edition 2014							
3. Modern Control Systems Engineering,	Nagrath I J and Gopal M	New age international, 3rd Edition, 2014.							
4. Linear Control System	B S Manke	Khanna Publishers, 12th edition							



	OEEC-622C													
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	End Semester Examination Marks 50													
Cours	<u>se</u>	Stı	idents v	vill be	introdu	ced to a	ctive a	nd pass	ive con	nponen	ts speci	fication	ns requ	ired for
<b>Objec</b>	design an electronic circuit. Designing of various power supply circuits. Selection of													
		CO	components will be explained. Problems in the transistor amplifier and how to use op											
		amp to solve these problems will be explained. This is necessary and essential in												•
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Cours	<u>se</u>	1.	Explain	and id	lentify t	he devi	ices wh	ich can	be use	d in app	olicatio	ns like	power	supply,
Outco	mes		amplifi	ers etc.										
2. Design and develop linear and variable power supply.														
			_		-			-	-		and or	o-amps.	_	
<ul><li>3. Address design challenges for amplifiers using transistor and op-amps.</li><li>4. Analyze and design different base drive circuits.</li></ul>														
		7.												
		1			of Cour	1				1	1	I		1
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1 CO<sub>2</sub> **CO3 CO4** Unit-I

**Practical circuit design issues and techniques:** Passive components, understanding and Interpreting data sheets and specifications of various passive and active components. design of electronic circuits by using these types of components, understanding and interpreting data sheets and specifications of various CMOS and TTL logic devices. CMOS/TTL interfacing issues, benefits and challenges on migration of 5V to 3.3V low voltage supplies.

Unit-II 12 hrs

**Power supply design techniques:** Regulated and unregulated power supply, conditions for proper operation of Zener regulator, transistor series voltage regulator, transistor Shunt voltage regulator, short circuit protection, foldback protection circuit, IC voltage regulators, fixed voltage regulators, adjustable voltage regulators design, dual voltage regulators design, differences between linear voltage power supply and SMPS.

Unit-III 12 hrs

**Amplifiers design challenges and techniques**: Basic amplifiers design, single stage amplifier, how transistor amplifies? Transistor audio power amplifier, small signal and large signal amplifier, difference between voltage and power amplifiers, operational amplifiers, circuit analysis using operational amplifier in different configurations.

Unit-IV 10 hrs



Cooling and grounding of electronic system: Heat transfer approach to thermal management, mechanisms for cooling, basic thermal calculations, heat sink selection, and heat sink design. Safety grounds, signal grounds, high frequency ground methods, low frequency grounding methods, chassis grounding.

RECOMMENDED BOOKS										
Title	Author	Publisher								
1. Electronic Instrument Design, 1st edition	Kim R. Fowler	Oxford University Press.								
2. Digital Design Principles& Practices, 3rd edition	John F. Wakerly	Prentice Hall								
3. Practical Analog Design Techniques	Adolofo Garcia and Wes Freeman	Seminar Materials								
4.The Art of Electronics	Paul Horowitz	Cambridge University Press, 2011								



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analogies. signal flow graphs, block diagram simplification for linear systems.

**Unit-II** 

System response: Time domain and frequency domain response of the first and second order systems. time domain specifications, steady state error and coefficients, type and order of system with P, PI, PD and PID controller, relation between time and frequency response for second order systems.

> **Unit-III** 12 hrs

Stability analysis: Pole-zero location and stability, Routh-Hurwitz criterion, root locus, log. magnitude versus phase angle plot, bode plots, Nyquist criterion for stability, necessity of compensation, lead, lag and lead-lag compensation networks.



Unit-IV 12 hrs

**State variable analysis**: State space representation of continuous time systems, state equations, transfer function from state variable representation, solution of state equations, controllability and observability, state space representation of discrete time systems.

RECOMMENDED BOOKS									
Title	Author	Publisher							
1. Modern Control Engineering	Ogata K	Prentice Hall, 5th Edition 2010							
2. Automatic Control Systems	Kuo BC	Prentice Hall, 9th Edition 2014							
3. Modern Control Systems Engineering,	Nagrath I J and Gopal M	New age international, 3rd Edition, 2014.							
4. Linear Control System	B S Manke	Khanna Publishers, 12th edition							



	PEEC-621B Telecommunication Switching Systems and Networks													
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Course Objectives The aim of this course is to study the basics of switching telecommunication transmission, designing of multistage network techniques, different networks, charging and routing plans. The course different technologies used for design of switching systems such as electivision switching and time division switching.  Course Outcomes  1. Understand the operation of telephone system and assess the network digitization.  2. Explain the working principle of switching systems involved in telection switching.  3. Design multi-stage switching structures involving time and space switching.  4. Analyze the signalling techniques and develop the numbering and charges the signalling techniques and develop the numbering and charges the signalling techniques and develop the numbering and charges the signalling techniques and develop the numbering and charges the signalling techniques and develop the numbering and charges the signalling techniques and develop the numbering and charges the signalling techniques and develop the numbering and charges the signalling techniques and develop the numbering and charges the signalling techniques and develop the numbering and charges the signalling techniques and develop the numbering and charges the signal techniques and develop the numbering and charges the signal techniques and develop the numbering and charges the signal techniques and develop the numbering and charges the signal techniques and develop the numbering and charges the signal techniques and develop the numbering and charges the signal techniques and develop the numbering and charges the signal techniques and develop the numbering and charges the signal techniques and develop the numbering and charges the signal techniques and the signal techniques are signal techniques and the signal techniques are signal techniques and the signal techniques are signal techniques and the signal										eed for ommunitching arging	voice ication stages.			
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CO2         3         3         3         1         0         0         1         1         0         1										1	2	2	3	
CO3	3	2	0	0	2	2	2	1	0	0	2	3	2	3
CO4	3	3	3	3	0	1	1	1	1	0	2	2	2	1
CO5	CO5         3         2         0         0         1         3         3         1         0         0         3         3         2         2													
	<u>Unit-I</u> 12 hrs													

**Telecommunications transmission**: Basic switching system, simple tele-phone communication. **Switching systems**: Stronger switching systems, cross bar switching, electronic switching – space division switching, time division switching –time division space switching, time division time switching, time multiplexed space switching, time multiplexed time switching, combination switching.

<u>Unit-II</u> 12 hrs

**Speech digitization & transmission**: Quantization noise, companding, differential coding, vocoders, pulse transmission, **Coding schemes:** Line coding, NRZ and RZ codes, Manchester coding, AMI coding, Walsh codes, TDM.

Unit-III 12 hr

**Traffic engineering**: Grade of service and blocking probability telephone networks, subscriber loops, switching hierarchy and routing, transmission plans and systems, signalling techniques, in channel, common channel.

**Control of switching systems:** Call processing functions, common control, and stored program control (For all type of switching systems).

Department of Electronics & Communication



<u>Unit-IV</u> 12 hrs

**Telephone networks and signalling**: Introduction, subscriber loops systems, switching hierarchy, transmission and numbering plans, common channel signalling principles, CCITT signalling systems.

transmission and numbering plans, common channel signalling principles, CC111 signalling systems.											
	RECOMMENDED BO	OOKS									
Title	Author	Publisher									
1.Telecommunications	Flood J E	Pearson education Asia, (2001).									
Switching, Traffic and											
Networks											
2.Telecommunication	Viswanathan T	PHI, India, (2003).									
Switching Systems and											
Networks											
3.Signaling in	Bosse J G van, Bosse	Wiley, John & Sons, (1997).									
Telecommunication Networks	John G										
4. Switching in IP Networks:	Bruce S. Davie, Paul	Elsevier Science & Technology Books,									
IP Switching, Tag Switching,	Doolan, Yakov Rekhtor	(1998)									
and Related Technologies											
5. Switching and Traffic	Joseph Yu Hui	Kluwer Academic Publishers, (1990).									
Theory for Integrated											
Broadband Networks											



And drain and source series resistances.						#00 P		EEC-62							
Sessional Marks						MOS D	evice F	hysics	and M	lodel				Cuadia	
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The course introduces active and passive components specifications required design an electronic circuit. It includes designing of various power supply circ selection of components, problems in the transistor amplifier and how to use op to solve these problems. The course emphasis on designing of heat sink, import of grounding and also imparting practical knowledge of electronic system design Poutcomes    1. Analyze current distribution in the devices like transistors, MOS devices.							· 4 ·	. N/1-							
design an electronic circuit. It includes designing of various power supply circ selection of components, problems in the transistor amplifier and how to use op to solve these problems. The course emphasis on designing of heat sink, import of grounding and also imparting practical knowledge of electronic system design.    Course Outcomes															
selection of components, problems in the transistor amplifier and how to use op to solve these problems. The course emphasis on designing of heat sink, import of grounding and also imparting practical knowledge of electronic system design [Course]  1. Analyze current distribution in the devices like transistors, MOS devices.  2. Derive models for the behavior of the electrical devices based on fundame physics.  3. Apply different SPICE transistor models for circuit analyses.  4. Compute terminal voltage and current characteristics for MOS transistors us SPICE Transistor model.  5. Extract various device parameters like effective channel length, threshold voltage and drain and source series resistances.  Mapping of Course Outcomes with program outcomes    PO1   PO2   PO3   PO4   PO5   PO6   PO7   PO8   PO9   PO10   PO11   PO12   PS01   PS									-		-	-		-	
to solve these problems. The course emphasis on designing of heat sink, import of grounding and also imparting practical knowledge of electronic system design I. Analyze current distribution in the devices like transistors, MOS devices.  2. Derive models for the behavior of the electrical devices based on fundame physics.  3. Apply different SPICE transistor models for circuit analyses.  4. Compute terminal voltage and current characteristics for MOS transistors uspice Transistor model.  5. Extract various device parameters like effective channel length, threshold voltand drain and source series resistances.    Mapping of Course Outcomes with program outcomes	<b>Objec</b>	<u>etives</u>		_						_	-	-			
Of grounding and also imparting practical knowledge of electronic system design						-									
1. Analyze current distribution in the devices like transistors, MOS devices. 2. Derive models for the behavior of the electrical devices based on fundame physics.   3. Apply different SPICE transistor models for circuit analyses.						_			_		_	_		_	
2. Derive models for the behavior of the electrical devices based on fundame physics.   3. Apply different SPICE transistor models for circuit analyses.   4. Compute terminal voltage and current characteristics for MOS transistors using SPICE Transistor model.   5. Extract various device parameters like effective channel length, threshold voltage and drain and source series resistances.   Mapping of Course Outcomes with program outcomes     PO1   PO2   PO3   PO4   PO5   PO6   PO7   PO8   PO9   PO10   PO11   PO12   PSO1   PSO1     CO1   3   3   3   3   3   3   3   3   3													•		ign.
physics   3. Apply different SPICE transistor models for circuit analyses.   4. Compute terminal voltage and current characteristics for MOS transistors usually spice transistor model.   5. Extract various device parameters like effective channel length, threshold voltage and drain and source series resistances.   Mapping of Course Outcomes with program outcomes   PO1   PO2   PO3   PO4   PO5   PO6   PO7   PO8   PO9   PO10   PO11   PO12   PSO1	Cours	<u>se</u>													
3. Apply different SPICE transistor models for circuit analyses. 4. Compute terminal voltage and current characteristics for MOS transistors us SPICE Transistor model. 5. Extract various device parameters like effective channel length, threshold voltand drain and source series resistances.    Mapping of Course Outcomes with program outcomes	Outco	<u>omes</u>													
4. Compute terminal voltage and current characteristics for MOS transistors used SPICE Transistor model.  5. Extract various device parameters like effective channel length, threshold voltand drain and source series resistances.    Mapping of Course Outcomes with program outcomes   PO1   PO2   PO3   PO4   PO5   PO6   PO7   PO8   PO9   PO10   PO11   PO12   PS01   P					- ·										
SPICE Transistor model.   5. Extract various device parameters like effective channel length, threshold voltand drain and source series resistances.   Mapping of Course Outcomes with program outcomes   PO1   PO2   PO3   PO4   PO5   PO6   PO7   PO8   PO9   PO10   PO11   PO12   PSO1   PSO															
S. Extract various device parameters like effective channel length, threshold voltand drain and source series resistances.    Mapping of Course Outcomes with program outcomes   PO1   PO2   PO3   PO4   PO5   PO6   PO7   PO8   PO9   PO10   PO11   PO12   PS01									current	char	acteristic	s for N	IOS tra	ansistor	s using
And drain and source series resistances.   Mapping of Course Outcomes with program outcomes   PO1   PO2   PO3   PO4   PO5   PO6   PO7   PO8   PO9   PO10   PO11   PO12   PSO1				SPI	CE Tra	nsistor	model.								
Mapping of Course Outcomes with program outcomes				5. Extr	5. Extract various device parameters like effective channel length, threshold voltage										
PO1				and	•										
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CO4 3 2 2 3 3 1 2 1 1 0 1 1 1 1 1 CO5 3 2 3 3 3 0 0 1 0 0 1 2 2 CO5 3 2 3 3 3 3 0 0 0 1 0 0 1 2 2 CO5 Introduction: Circuit design, MOSFET modelling, and model parameters, interconnects    Unit-II	CO2	3	3	3	3	3	2	2	1	0	0	1	2	3	2
CO5 3 2 3 3 3 0 0 1 0 1 2 2    Unit-I	CO3	3	2	1	2	3	1	1	1	1	0	2	2	1	3
Introduction: Circuit design, MOSFET modelling, and model parameters, interconnects  Unit-II  MOS transistor structure and its operation: Characteristics, scaling theory, hot carrier effects, para elements, MOSFET circuit models, modelling of hot carrier and short channel effects.  Unit-III  MOS capacitor: MOS capacitor with zero and nonzero basic-V curves, anomalous C-V curves, uniform doped substrate.  Unit-IV  SPICE MOSFET models: Introduction, basic concept LEVEL 1 model equations, LEVEL 2 m equations, LEVEL 3 model equations and LEVEL 4 model's equations.  RECOMMENDED BOOKS  Title  Author  Publisher	CO4	3	2	2	3	3	1	2	1	1	0	1	1	1	3
Introduction: Circuit design, MOSFET modelling, and model parameters, interconnects  Unit-II  MOS transistor structure and its operation: Characteristics, scaling theory, hot carrier effects, para elements, MOSFET circuit models, modelling of hot carrier and short channel effects.  Unit-III  MOS capacitor: MOS capacitor with zero and nonzero basic-V curves, anomalous C-V curves, uniform doped substrate.  Unit-IV  SPICE MOSFET models: Introduction, basic concept LEVEL 1 model equations, LEVEL 2 m equations, LEVEL 3 model equations and LEVEL 4 model's equations.  RECOMMENDED BOOKS  Title  Author  Publisher	CO5	3	2	3	3	3	0	0	1	0	0	1	2	2	2
Unit-II		1					Unit-I								12 hrs
MOS transistor structure and its operation: Characteristics, scaling theory, hot carrier effects, para elements, MOSFET circuit models, modelling of hot carrier and short channel effects.  Unit-III  MOS capacitor: MOS capacitor with zero and nonzero basic-V curves, anomalous C-V curves, uniform doped substrate.  Unit-IV  SPICE MOSFET models: Introduction, basic concept LEVEL 1 model equations, LEVEL 2 m equations, LEVEL 3 model equations and LEVEL 4 model's equations.  RECOMMENDED BOOKS  Title  Author  Publisher	Introd	duction	ı: Cir	cuit desi	gn, MO	SFET	modell	ing, an	d mode	el par	ameters,	interco	nnects		
elements, MOSFET circuit models, modelling of hot carrier and short channel effects.    Unit-III							Unit-II	<u>.</u>							12 hrs
MOS capacitor: MOS capacitor with zero and nonzero basic-V curves, anomalous C-V curves, uniform doped substrate.    Unit-IV						_								fects, p	arasitic
MOS capacitor: MOS capacitor with zero and nonzero basic-V curves, anomalous C-V curves, uniform doped substrate.    Unit-IV	eleme	nts, MO	OSFE'	Γ circuit	models				rrier ar	nd sho	ort chann	el effec	ets.		
uniform doped substrate.  Unit-IV  SPICE MOSFET models: Introduction, basic concept LEVEL 1 model equations, LEVEL 2 m equations, LEVEL 3 model equations and LEVEL 4 model's equations.  RECOMMENDED BOOKS  Title  Author  Publisher															12 hrs
Unit-IV     12       SPICE MOSFET models: Introduction, basic concept LEVEL 1 model equations, LEVEL 2 m equations, LEVEL 3 model equations and LEVEL 4 model's equations.       RECOMMENDED BOOKS       Title     Author     Publisher		_			pacitor	with z	zero and	d nonze	ero bas	ic-V	curves, a	nomal	ous C-V	√ curve	es, non-
SPICE MOSFET models: Introduction, basic concept LEVEL 1 model equations, LEVEL 2 m equations, LEVEL 3 model equations and LEVEL 4 model's equations.  RECOMMENDED BOOKS  Title Author Publisher	unifor	m dope	ed sub	strate.											
equations, LEVEL 3 model equations and LEVEL 4 model's equations.  RECOMMENDED BOOKS  Title Author Publisher															12 hrs
RECOMMENDED BOOKS Title Author Publisher															
Title Author Publisher	equati	ons, LI	EVEL	3 model	equati										
						RE	COMN	1ENDI	ED BO	OKS					
1. Fundamental of Modern VLSI Design Yuan Taur, Tak H Ning   Cambridge University Press, 201			1	itle				Auth	or			Pı	ıblishe	r	
	1. Fun	damen	tal of	Modern	VLSI I	Design	Yuan T	Taur, Ta	ak H Ni	ing	Cambrid	ge Uni	versity	Press,	2011
2. CMOS Digital Integrated Circuits Sung-Mo Kang Tata McGraw Hill	2. CM	OS Di	gital I	ntegrated	l Circu	its	Sung-N	Mo Kan	ıg		Tata Mc	Graw F	Hill		
3. Operation and Modelling of the MOS Yannis Tsividis Oxford University Press	3. Ope	eration	and M	Iodelling	of the	MOS	Yannis	Tsivid	is		Oxford I	Jnivers	ity Pre	SS	
Transistor	_												-		



PCEC-623													
	Linear Integrated Circuit Lab												
			L			T		P			Cre	edits	
			0			0		2				1	
Course	This 1	ab incl	udes c	omple	te anal	ytical a	s well	as desi	gning c	ircuits ı	ısing op	o-amp. I	t includes
<b>Objectives</b>	design	design of various applications using op-amp as integrator, differentiator, log, antilog and											
	wave generation circuits.												
Course	1. Exa	imine t	he per	formar	ice of	op-amp	in inv	erting a	as well a	as in no	n-inver	ting mod	des.
<b>Outcomes</b>	2. Des	sign of	variou	ıs appli	ication	s using	op-an	ıp.					
	3. Des	sign dif	ferent	wave	genera	ting cir	cuits t	ising or	o-amp.				
	4. Design of 555 timer and PLL circuit.												
	Mapping of Course Outcomes with program outcomes												
PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

		141	apping	, or co	urbe o	utcom	CB WILL	i pros	i uiii ou	teome	,,			
01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
3	3	3	3	2	0	0	1	3	2	1	2	3	3	
3	3	3	3	3	2	2	1	3	2	1	2	3	2	
3	3	3	3	3	2	2	1	3	2	1	2	3	3	

## **List of Experiments:**

CO1

CO<sub>2</sub>

**CO3** 

CO4

- 1. Design and analyze RC-circuit as low pass and high pass using active filters.
- 2. Design and analyze RC-circuit as low pass and high pass using passive filters.
- 3. Verify the differential amplifier configurations.
- 4. Measure the performance parameters of an op-amp.
- 5. Application of op-amp as inverting and non-inverting amplifier.
- 6. Verify the frequency response of an op-amp.
- 7. Use the op-amp as summing, scaling & averaging amplifier.
- 8. Use the op-amp as instrumentation amplifier.
- 9. Design and analyze differentiator and integrator using op-amp.
- 10. Application of op-amp as log and antilog amplifier.
- 11. Application of op-amp as saw tooth wave generator.
- 12. Application of op-amp as Schmitt Trigger.
- 13. Design and analyze multivibrator circuits using 555.
- 14. To examine the operation of a PLL and to determine the free running frequency, the capture range and the lock in range of PLL.

A. Marwaha

2

3



	PCEC-624															
	MATLAB Programming Lab															
				L			T		P			Cred	lits			
Cour	<u>se</u>	The	The aim of this course is to introduce the students to the MATLAB programm													
Obje	ctives		language for numerical computations and its application in engineering and technolog													
Cour	se	1. U	1. Understand basic commands, manage contents and develop programs in MATLAB.													
Outc	omes	2. F														
		3. E	E C													
					•	-			earning	g and pe	erformai	nce in e	ngineer	ing.		
		N	<b>Iappi</b> r	ng of C	Course	Outco	mes v	vith Pr	ogran	n Outco	mes					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO1	2	3	3	3	3	1	0	1	3	2	1	2	2	3		
CO2	2	3	3	3	3	1	2	1	3	2	1	3	2	3		
CO2	_					_	_	-		_	_		_			
CO3	2	3	3 3 3 3 0 1 3 2 1 2 2 3													
CO4	2	1	1 3 3 3 3 2 1 3 2 1 3 3 3											3		
т.	4 615															

## **List of Experiments:**

- 1. Familiarizing with basic elements of MATLAB's desktop, MATLAB windows, MATLAB editor input-output, file types, general commands, variables, numbers, working with arrays of numbers and array arithmetic operations.
- 2. Write a MATLAB program to display a matrix. Also find its length, width, divergence, transpose and inverse.
- 3. Write a MATLAB program to calculate matrix addition, multiplication, division and eigen value calculations.
- 4. To study basic 2-D plots, style options, labels, title, legend, and other text objects, axis control, modifying plots specialized 2-D plots, layout of multiple plots, mesh and surface plots, 3-D plots.
- 5. Write a script file to calculate addition, subtraction, multiplication, division, square, square root, cube and cube roots of integer numbers.
- 6. Familiarizing with control flow structures branching statements, loops and their operators.
- 7. Write a script file to find the largest of three numbers (use if-elseif-else).
- 8. Generate a 10-by-10 matrix A = [akl], where akl = sin(k)cos(l). (use for loop)
- 9. The number  $\pi$  is divided by 2. The resulting quotient is divided by 2 again. This process is continued till the current quotient is less than or equal to 0.01. Write a script file to find the largest quotient that is greater than 0.01? (use while).
- 10. Write a script file to generate 5 different magic squares.
- 11. Fibonacci numbers are computed according to the following relation:
- 12.  $F_n = F_{n-1} + F_{n-2}$ , with  $F_0 = F_1 = 1$
- 13. Create a function for generating the Fibonacci numbers with user defined function as (function  $f = Fib_1(n)$ )
- 14. To study functions for numerical integration,
- 15. To study functions for differential and non-linear algebraic equations.
- 16. To study symbolic computation in MATLAB and evaluate symbolic expressions.

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## MATLAB SIMULINK

- 1. To generate BASK signal and observe the frequency spectrum on MULTISIM software.
- 2. To generate BPSK signal and observe the frequency spectrum on MULTISIM software.
- 3. To generate BFSK signal and observe the frequency spectrum on MULTISIM software.
- 4. To setup the model for BPSK baseband modulation for scatter plot to observe the constellation on MATLAB/SIMULINK software.
- 5. To setup the model for QPSK baseband modulation for scatter plot on to observe the constellation on MATLAB/SIMULINK software.
- 6. To setup the model for BFSK baseband modulation for scatter plot on to observe the constellation on MATLAB/SIMULINK software.
- 7. To setup the BPSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.
- 8. To setup the QPSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.
- 9. To setup the BFSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.



TPID-621 Industrial Training (4 weeks)																
	Industrial Training (4 weeks)  L T P Credits															
			I			7	Γ	]	P			Credits	5			
			(	)		(	0	4	0			2 (S/US	)			
Cour	<u>se</u>	The n	The main objective of industrial training is to familiarized students with industrial working													
<u>Objec</u>	<u>ctives</u>	envir	environment and enhance their knowledge skills towards developing a holistic perspective													
		to un	to understand various practical issues and latest trends in the field. The students will be													
		able t	able to troubleshoot various engineering faults related to their respective fields. They will													
		be ab	be able to learn ethical management practices.													
Cour	<u>se</u>	After	After successful completion of industrial training, the students should be able to													
Outco	omes	1: im	1: implement the technical skills as an individual and in team.													
		2: co	2: correlate the theoretical concepts with the real-life industrial environment.													
								nsform	ing the	emselve	s into	an optii	num bl	end of		
		1		-	cticing	_										
		4: ex										unicatio	on.			
			Ma	apping	of Co	urse O	utcon	ies wit	h prog	gram ou	tcomes	}				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO1	3	2	2	2	2	2	2	3	3	3	1	3	3	1		
CO2	3	2	2 3 3 3 3 2 2 3 1 3 3 1													
CO3	3	3 2 3 2 2 2 1 3 1 3 3														
CO4	1	1 1 1 1 1 1 3 3 1 3 1 3														
		1						1	1			<u> </u>		l		



PCEC-711											
Digital Signal Processing											
	L	T	P	Credits							
	3	0	0	3							
	Sessional Marks			50							
	End Semester Examination	n Marks		50							
Course The aim of this course is to acquire knowledge of discrete time systems, Z-transform,											
<b>Objectives</b>											
	Implementation and designing	ng of FIR and	IIR filters and realization	of their structures.							
	The concept of multirate si	gnal processi	ng and sample rate conv	ersion will also be							
	discussed.										
Course	1. Analyze linear time invar	iant systems.									
Outcomes	2. Compute Z-transform, DI	•	discrete time signals.								
3. Understand the concepts of multirate signal processing.											
	4. Design digital filters using standard techniques.										
			1								
	Mapping of Course Outcomes with program outcomes										

			Ma	apping	<u>of Cou</u>	<u>rse Ou</u>	tcomes	with j	prograi	m outc	omes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	0	0	1	0	0	1	1	2	3
CO2	3	3	3	3	3	0	1	1	2	0	0	2	2	3
CO3	3	3	3	3	2	1	1	1	1	0	1	2	1	3
CO4	2	3	3	3	2	1	0	1	0	0	2	3	3	3
	•	•	•	•			•	•	•		•	· 1	•	

**Introduction**: Advantages of digital signal processing over analog signal processing and its applications; basic elements of digital signal processing systems, concept of frequency in discrete time sinusoidal and harmonically related complex- exponential signals, review of discrete-time signals and systems, analysis of discrete-time systems, discrete-time systems described by difference equation, correlation of discretetime signals.

**Unit-II** 

**Z-transform**: Introduction to Z- transform and inverse Z-transform, region of convergence, properties of Z transform, analysis and characteristics of LTI systems using Z- transforms.

Discrete Fourier transform (DFT): Introduction to DFT, inverse DFT, DFT as a linear transform, relationship of DFT with other transforms, properties of DFT, circular convolution, use of DFT in linear filtering, filtering of long sequences. efficient computation of the DFT, fast Fourier transform algorithm using decimation in time and decimation in frequency techniques.

> **Unit-III** 16 hrs

Implementation of discrete time system: Structures for the realization of discrete-time systems, structure for FIR & IIR systems, fixed point and floating-point representations, effects of coefficient unitization, effect of round off noise in digital filters, limit cycles.

**Design of digital filters:** General consideration, linear phase FIR filters, design methods for FIR filters using windows, IIR filter design by impulse invariance, bilinear transformation and matched Ztransformation.



and and	Unit-IV		06 hrs						
Multirate signal processing: Introduction, interpolation and decimation.									
RECO	MMENDED BOOKS								
Title	Author	Publisher							
1. Discrete Time Signal Processing, 3rd Edition 2014	Oppenheim A V & Sehafer R W	Prentice Hall							
2. Digital Signal Processing, 4th Edition 2006	Proakis J G & Manolakis D G	Pearson							
3. Signal & Systems, 2nd Edition 2009	Oppenheim A V, Willsky A S & Young I T	Wiley Eastern Ltd N Delhi	V.						
4. Digital Signal Processing, 4th Edition 2013	S.K Mitra	Tata Mc-Graw Hill							

Department of Electronics & Communication



						F	PCEC-7	12						
					Anten	na an	d Wave	e Prop	agation	ì				
				L			,	Т		P			Credi	its
				3				0		0			3	
		Se	ssional	Mark	S								50	
		En	d Sem	ester E	xamin	ation I	Marks						50	
Object Cours	The aim of course is to understand radiation principles, antenna fundamentals and their basic parameters. Various antennas, arrays and their special features and application will also be discussed. The wave propagation will enable the students to learn the atmospheric electrical structure and its propagation properties.  Course  1. Understand radiation principles and various antenna parameters.  Dutcomes  2. Describe the atmospheric and terrestrial effects on radio wave propagation.													
		3. 4.	Synth	esize aı	ntenna	arrays	diators, and ana tcomes	lyze th	eir radi	ation p	atterns.		applica	ntions.
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	1	2	0	1	3	2	2
CO2	3	3	3	2	3	3	1	1	1	0	2	3	2	3
CO3	3	3	3 2 2 1 2 1 2 0 1 3 2 3											
CO4	3	2	2	3	3	1	2	1	2	0	2	2	3	2
	1	1	I	1	U	nit-I	1	1	Ī	Ī	Ī	Ī	1	12 hrs

**Basic antenna parameters**: Radiation mechanism, radiation patterns, antenna beam area, antenna beam width, radiation intensity, gain, directive gain, power gain, directivity (D), antenna bandwidth, effective height, reciprocity theorem, self-impedance, mutual impedance, radiation resistance, front to back ratio, radiation power density.

**Radiation principles**: Retarded vector potential, isotropic radiators, near field and far field concept, radiation from a half wavelength dipole, power radiated by a current element and its radiation resistance.

Unit-II 12 hrs

**Wire radiators**: Voltage and current distribution, asymptotic current distribution in dipole, analysis of linear wire elements, Hertz dipole antenna, monopole radiators, resonant and non-resonant antennas.

**Special antennas**: Aperture antennas, E & H -plane horn antennas, pyramidal horn, lens and reflector antenna, frequency independent antennas, log periodic antenna, antenna measurements, microstrip antennas & their advantages, antenna for receiving and transmitting TV signals e.g. Yagi-Uda and turnstile antennas.

Unit-III 12 hrs

**Antennas array:** Introduction, linear uniform arrays of isotropic sources, principles of pattern multiplication. broadside arrays, end fire arrays, array pattern synthesis, uniform array, binomial array, Chebyshev arrays.



Unit-IV 12 hrs

**Propagation of radio waves**: Structure of ionospheric region, different modes of propagation: ground waves, space waves, space wave propagation over flat and curved earth, optical and radio horizons, surface waves and troposphere waves, wave propagation in the ionosphere, critical frequency, maximum usable frequency (MUF), skip distance, virtual height, radio noise of terrestrial and extraterrestrial origin, effect of earth's curvature, duct propagation, troposphere scatter propagation.

RECOMMENDED BOOKS										
Title	Author	Publisher								
1. Antennas	Kraus	Mc Graw Hill								
2. Antennas	Balanis	Mc Graw Hill								
3. Antenna and Wave Propagation	K D Parsad	Parkash Publications								
4. Electromagnetic Waves and Radiating Systems	K. G Balmain, E. Jordan	СРНІ								



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Course Outcomes	their	use in	micro	pelecti	cal and ronic c fabric	circuit	S	-			icondı	uctor 1	materi	als and
	4. Proce	ess int	egratio	on for	I fabrio NMO se Out	S, CN	IOS a	nd bip	olar c	ircuits				
	PO1	PO2		PO4		PO6	PO7		PO9			PO12	PSO1	PSO2
CO1	3	3	3	3	2	0	0	1	0	1	3	0	2	2
CO2	3	1	3	2	3	0	3	1	0	0	2	0	2	3
СОЗ	3	2	2	1	0	0	0	1	0	2	3	0	3	3
CO4	3	2	2	1	0	0	0	1	1	2	3	0	1	2
	-			Unit	-I	-	•	•		-		-	-	10 hrs
Introduction: landscape, class														
-				Linit	TT							-		10 hrs

**Unit-II** 

Crystal growth: Bridgeman and Czochralski techniques, clean room basicsinfrastructure, advanced MOS cleaning, gettering etc.

Oxidation: Surface passivation using oxidation, dry oxidation, wet oxidation, kinetics of Silicon dioxide growth for, thick thin and ultrathin films, Oxidation technologies in VLSI and ULSI, characterization of oxide films, High k and low k dielectrics for ULSI.

**Unit-III** 14 hrs

**Lithography:** Photo reactive materials, types of photoresists, pattern generation and mask-making, pattern transfer, lithography process steps.

**Diffusion and ion implantation:** Interstitial diffusion, substitutional diffusion, interstitially diffusion, diffusion equation, Fick's first law and second law, ion implant distribution, penetration range, nuclear stopping, electronics stopping, implantation damage and annealing.

Epitaxy and thin film deposition: Historical development and basic concepts, chemical vapour deposition (CVD), atmospheric pressure chemical vapour deposition (APCVP), vapour phase epitaxy (VPE), liquid phase epitaxy (LPE), molecular beam epitaxy (MBE),

**Unit-IV** 

Etching: Historical development and basic concepts, wet etching, selectivity, isotropy and etch bias, common wet etchants, orientation dependent etching effects.

Metal film deposition: Evaporation and sputtering techniques, Failure mechanisms in, metal interconnects and multi-level metallization schemes.

Department of Electronics & Communication



RECOMMENDED BOOKS												
Title	Author	Publisher										
1.The Science and Engineering of	Stephen A. Campbell	Oxford University Press										
Microelectronic Fabrication												
2. Fundamentals of Semiconductor	S. M. Sz	Wiley, 2003										
Fabrication												
3.Introduction to Microelectronic	Richard C Jaeger	Prentice Hall, 2002										
Fabrication												



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Objec		dev opte con	rices a oelectro nmunic	and cir	cuits levices system.	by us: . Imple	ing di ementa	fferent tion ap	desig	n tech of opt	nologie oelectro	s used onics de	for d	lesign of n modern lectronics	
1. Use principles of physics to analyze the fundamental concepts of optoelectronic components.   2. Describe the characteristics of optoelectronic devices.   3. Familiarize with tools and processes used in fabricating optoelectronic components.   4. Utilize knowledge to implement optoelectronic communication systems.   Mapping of Course Outcomes with program outcomes															
												PSO2			
CO1	2	2	3	3	3	0	2	1	0	2	3	0	2	3	
CO2	3	3	3	3	3	2	0	1	2	2	3	0	2	3	
CO3	3	3	2	2	3	0	1	1	2	2	3	0	2	3	
CO4	3	3	3	3	2	1	2	1	2	2	3	0	1	3	
<u>Unit-I</u> 10 hrs															
				ctors, c etwork							tronics,	need o	f optoel	ectronics,	
_	_					<u>it-II</u>								14 hrs	
Optoelectronic sources: Introduction, basic concepts, optical emission from semiconductor, semiconductor injection laser & its various structures, injection laser characteristics, threshold condition, wavelength tunable lasers, LED power and efficiency, heterojunction, LED structure designs, characteristics, modulation response of an LED.  Optoelectronic detectors: Introduction, device types, basic principal of optoelectronic detection, absorption, quantum efficiency, responsivity, wavelength cut-off, types of photodiodes with and without internal gain, mid-infrared photodiode, phototransistors, photo conducting detectors, noise considerations  Unit-III  16 hrs															
			_							_	_			tiplexers,	
demultiplexers, filters, isolators, circulators, attenuators, electro-optic modulators, acousto-optic modulators and their application areas, optical sensors: classification-point, distributed, intensity, phase & spectral. smart structures & applications															
<b>Optical amplifiers and integrated optics:</b> Introduction, semiconductor optical amplifiers (SOA), erbium-doped fiber amplifiers (EDFA), fiber Raman amplifiers (FRA), application areas of optical amplifiers, some integrated optical devices, OEICs, optical bi-stability and digital optics, optical computation.															
						it-IV			_ 1	1				12 hrs	
Optoelectronic integrated circuits: Introduction, hybrid and monolithic integration, application of opto electronic integrated circuits, integrated transmitters and receivers, guided wave devices.  RECOMMENDED BOOKs															

Department of Electronics & Communication

Page 88



Title	Author	Publisher				
1. Semiconductor Optoelectronic Devices	Pallab Bhattacharya	Pearson Education Inc				
2. Photonics - Optical Electronics in Modern Communications	A. Yariv and P. Yeh,	Oxford University Press				
3.Opto Electronics – As Introduction to materials and devices	Jasprit Singh	McGraw-Hill International				
4.Opto Electronics – An Introduction	J. Wilson and J. Haukes	Prentice Hall, 1995				



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					Comp L	puter	Comr	<u>nunic</u> T	cation	&Net	works P			Credits
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Obje	CHYCS			/IP me	_	ologic	.s. Lii	pnasi	.5 W111	oc iaic	ı on co	vering	the basic	layers used in
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											etworl		•11 <i>)</i> •	
												tcomes	}	
	PO1	PO2		PO4			PO7	PO8	PO9	PO10		PO12	PSO1	PSO2
CO1	0	3	3	2	1	1	0	1	2	0	1	2	2	2
CO2	3	2	3	3	2	2	2	1	0	0	2	2	1	2
CO3	1	3	3	2	0	1	1	1	1	0	2	2	1	2
CO4	3	3	3	3	0	1	1	1	2	0	2	3	2	2
					ı	Unit	-T	ı		1				12hrs
Phys medialink of	ical lay a and sy	of corels, cor	npute nparis ta and g. d nety	r netwood of sign	orks- OSI a als, di	LAN and TO Unit- gital a  Unit- Introd	, MAN CP/IP. II and ar III ductio	n to d	transn	AN. in	n, band	width u	t and ext	12 hrs n, transmission 14 hrs correction, data ols, unicast and
IIIuIti	cast rou	ung.				Timit i	TX7							10 hwa
Transport layer and application layer: Process to process delivery: TCP and UDP, application layer protocols, FTP, HTTP.														
						REC	OMM	END	ED B	OOKS	5			
	Title					Auth	or					Pı	ıblisher	
1. Da	ta		B.A.	Foro	uzan					4th	Ed., T	ata Mc	Graw-Hi	11.
Com	municat	ion												
and N	letwork	ing												
2. Co	mputer		A.S	Tanen	baum					4th	Ed., P	earson	Educatio	n
Netw	orks													
3. Da	ta and		W. S	tallin	gs					8th	Ed., P	rentice-	Hall.	
Com	-													
Com	municat	ion												



						PE	EC-71	2A							
				]	Microv	vave &	Radaı	: Engir	neering	5					
				L			T			P		Credits			
				3			0			0		3			
		Sess	ional N	Marks									50		
		End	Semes	ster Ex	amina	tion M	arks					50			
Course	<u>e</u>	The	aim o	f this	course	is to u	ndersta	nd the	basic	concep	ts and	applica	tion a	reas of	
<b>Object</b>	tives		microwave and radar. This course enables students to have fundamental understanding												
		of microwave components and circuits and to learn the principle of transmission lines													
and waveguides. The students will also study about various types of radar systems, rad															
transmitter-receiver circuits and various scanning radars.													, radar		
<u> </u>															
Course										•		study v	vide ra	inge of	
Outco	mes				-		vices an					h ama ata	miatiaa		
			-		_		owave a aracteri								
							nd tracl						1118.		
		4. 1					comes					1.			
	PO1	PO2	PO3	PO4			PO7	PO8				PO12	PSO1	PSO2	
CO1	3	3	2	3	1	3	2	1	2	0	1	3	2	2	
			_		_		_	_			_		_		
CO2	3	3	3	3	2	3	2	1	1	0	1	3	3	2	
CO3	3	3	2	3	3	3	2	1	2	0	2	3	2	1	
CO4	3	3	3	3	3	3	2	1	2	2	1	3	2	1	
	<u> </u>				Ur	nit-I				<u>l</u>				12 hrs	

Microwave components and tubes: Introduction to microwaves, microwave frequency spectrum, wave guides-basic concepts and properties, ferrite devices, faraday rotation, isolators, circulators, detector mounts, magic tee, frequency meter, cavity resonator, microwave filters, directional couplers, loop directional couplers, two-hole directional coupler, phase shifters, attenuators, introduction to S parameters, microwave tubes- Problem with conventional tubesat microwave frequencies, two cavity klystrons, multi cavity klystron, reflex klystron, , magnetrons, travelling wave tube.

<u>Unit-II</u> 12 hrs

**Microwave devices and measurements:** Transistors, varactor diodes, step recovery diode, tunnel diode, Gunn diode, avalanche diode, IMPATT diode, TRAPPAT diode, PIN diodes, parametric amplifier, General measurement setup with microwave bench, measurement devices, power measurement, attenuation measurement, measurement of VSWR, measurement of impedance, measurement of Q of a cavity resonator, and set up for S parameter measurement.

<u>Unit-III</u> 12 hrs

**Introduction to radar systems** Basic principle, block diagram, operation and applications of radar, radar range equation, CFARs pulse repetition frequency and range ambiguities, **Doppler radar:** Doppler effect, moving target indicator (MTI) radar, delay line cancellers, blind speeds, multiple or staggered pulse repetition frequencies, range gated doppler filters, block diagram of digital signal processor, pulse doppler radar, non-coherent MTI; basic CW radar, FMCW radar, multiple frequency CW radar: block diagram and operation for the measurement of range

Department of Electronics & Communication

Page 91



Unit-IV 12 hrs

**Radar Systems**: Radar transmitters, basic configurations: self-excited power oscillator, master oscillator power amplifier (MOPA), comparison of tubes for radar transmitters, modulators, pulse forming network, block diagram of radar receiver, mixers, duplexers, displays

**Tracking and scanning**: tracking with radar, sequential lobbing, conical scanning, block diagram and operation, simultaneous lobing or monopulse tracking radar, amplitude comparison monopulse radar, block diagram and description for one angular coordinate and two (angular azimuth and elevation) coordinates, phase comparison monopulse radar.

RECOMMENDED BOOKS										
Title	Author	Publisher								
1. Microwave and Radar Engineering	M Kulkarni	Umesh Publications, Delhi								
2. Foundation of Microwave Engg	R. E. Collin	Tata McGraw Hill								
3. Introduction to Radar Systems	Skolnik, M.	Tata McGraw-Hill, 2001								
4.Microwaves	K C Gupta	New Age International								
5.Elements of Electronic Navigation Systems	N. S. Nagaraja	Tata McGraw-Hill, 2000								
6. Introduction to Radar Engineering	Sen & Bhattachrya	PHI								



						PE	EC- 7	12B							
				Con	nputer	Archit	tecture	and C	<b>)rganis</b>	ation					
				L			T			P			Credi	ts	
				3			0			0			3		
		Sessi	ional N	larks								50			
		End	Semes	ter Exa	ıminat	ion Ma	rks					50			
Cours	<u>se</u>	The course introduces foundation of computer organization and architecture,												rdware-	
Objec	ctives	software interface, hierarchical memory system including cache memory, associative													
		memory and virtual memory. The course familiarizes the students with arithmetic and													
		logic unit and implementation of fixed point and floating-point arithmetic operations, and													
	concepts of the parallel processing.														
Cours	Course 1. Recognize the architectures of processors used in computing systems.														
Outco	omes	2. F	amiliar	ize wit	h comp	outer in	structio	n set a	ind exec	cution u	ınit.				
		3. Id	dentify	trade-c	offs in c	lesignir	ng of co	ompute	er proce	ssor inc	cluding	memo	ry.		
		4. E	Evaluate	quanti	itative 1	perform	nance o	f comp	outer sy	stems a	nd mer	nory.			
			Ma <sub>j</sub>	pping o	of Cou	rse Out	tcomes	with	prograi	m outc	omes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	2	2	0	1	1	1	0	0	2	2	3	2	
CO2	2	3	3	3	0	1	2	1	2	0	0	3	3	2	
CO3	2	0	0	3	0	3	3	1	1	0	2	2	2	3	
CO4	3	2	2	2	0	0	1	1	2	0	1	3	2	2	
					U	nit-I					·		•	10 hrs	

**Introduction**: Evolution of computer, hardware, software and firmware, computer architecture, types of computer, different types of buses.

**Data representation**: Signed number representation, fixed and floating-point representations, character representation.

Unit-II 14 hrs

Computer instruction set: Introduction, opcode encoding, addressing modes, instruction types, data transfer, arithmetic, logical, program and system control, reduced instruction set computers, RISC vs CSIC, basic parallel processing techniques: instruction level, thread level and process level.

Unit-III 14 hrs

**Execution unit**: Introduction, general register and combinational shifter design, flag register, computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, booth multiplier, carry save multiplier, division - non-restoring and restoring techniques, floating point arithmetic, ALU design, bit slice processor, coprocessors.

**CPU control unit design**: Introduction, basic concepts, hardwired and micro-programmed design approaches, case study - design of a simple hypothetical CPU.



<u>Unit-IV</u> 14 hrs

**Memory organization**: Introduction, memory interleaving, characteristics of memory systems, main memory design, concept of hierarchical memory organization, cache memory: cache size vs block size, mapping functions, replacement algorithms, write policy, associative memory, virtual memory and memory management concepts.

**Peripheral devices and their characteristics**: Input-output subsystems, basic concepts programmed I/O, standard vs memory mapped I/O, I/O transfers - program controlled, interrupt driven and DMA, software interrupts and exceptions.

RECOMMENDED BOOKS									
Title	Author	Publisher							
1. Computer Organization and	Carl Hamachar, Zvonco	5th Edition, McGraw-Hill,							
Embedded Systems	Vranesic and Safwat Zaky	2002							
2. Computer Organization and	William Stallings	6th Edition, Pearson, 2003							
architecture – Designing for									
Performance									



							EEC-71								
					I	ndust	rial Ele	ctroni	cs						
				L			T			P			ts		
				3			0			0			3		
		Ses	sional I	Marks								50			
		Enc	d Seme	ster Ex	kaminat	ion M	arks					50			
Cours Object		chai	acterist	tics of	to equip power s ac/dc re	semico	onducto	r devi	ces and	l funda	mental	s of po	wer co	nverter	
	circuits including ac/dc rectifiers, dc/ac inverters, dc/dc converters and ac/ac converters.  1. Acquire knowledge about fundamental concepts and techniques used in power electronics.  2. Learn the characteristics of power semiconductor switches.  3. Analyze single phase and three phase power converter circuits and their applications.														
		4.	Unders	tand th	e use of	power	r conve	rters in	comm	ercial a	nd ind				
			Mappi	ng of (	Course (	Outcor	mes wi	th pro	gram o	utcom	es				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	3	3	3	2	1	0	1	1	0	1	1	1	1	
CO2	2	2	1	2	2	0	2	1	2	0	0	2	1	1	
CO3	3	3	3	3	2	2	2	1	3	0	2	3	2	2	
CO4	3	3	3	3	2	2	2	1	3	0	3	3	2	2	
	-1	ı	1		Un	it-I	1	1		l	1		1	16 hrs	

**Introduction**: Concept of power electronics, applications of power electronics, power electronic systems, power semiconductor devices, types of power electronic converters, power electronic modules.

**Semiconductor switching devices**: Review of thyristor, two transistor model of SCR and V-I characteristics, thyristor turn-on methods, thyristor ratings and protection, gate characteristics, series and parallel connections of SCR, other members of thyristor family-DIAC, TRIAC, GTO, power MOSFET, firing circuits for thyristors, thyristor commutation techniques.

Unit-II 12 hrs

**Power rectification**: Principle of phase control, classification of rectifiers, single phase and three-phase rectifiers, semi converters, full converters, freewheeling diodes, transformer utility factor, effect of source impedance on the performance of rectifier, dual converters.

<u>Unit-III</u> 12 hrs

**Inverters**: Introduction, single phase voltage source inverters, current source inverters, force-commutated thyristor inverters, voltage control in single phase inverters, PWM inverters, series inverters, single phase parallel inverters.

<u>Unit-IV</u> 14 hrs

**Choppers**: Principles of chopper operation, control strategies, types of chopper circuits, thyristor chopper circuits.

**Cyclo-converters:** Principle of cyclo-converter operation, step-up and step down cyclo-converter, three phase half wave cyclo-converters, output voltage equation for a cyclo-converter.

Department of Electronics & Communication



RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Power Electronics-Circuits, Devices and Applications	M H Rashid	PHI, 2nd Edition (1998).									
2. Industrial Electronics	G K Mithal	Khanna Publishers, Delhi, 18th Edition (1998).									
3. Industrial Electronics	S N Biswas	Dhanpat Rai and Company, Delhi, 3rd Edition (2000).									
4. Power Electronics	P S Bhimbra,	Khanna Publishers, Delhi, 3rd Edition (2002).									
5. Power Electronics	M D Singh, Khanchandani K B	TMH, 6th reprint (2001).									



		OEEC-711A								
Digital Systems										
	L	T	P	Credits						
	3	0	0	3						
	Sessional Marks			50						
	End Semester Examina	tion Marks		50						

#### <u>Course</u> Objectives

This course provides a modern introduction to logic design and the basic building blocks used in digital system. The course deals with sequential circuits, random access memories, and modern logic devices such as field programmable logic gates. State machines will then be discussed and illustrated through case studies of more complex systems using programmable logic devices. The course has an accompanying lab component that integrates hands-on experience with modern computer-aided design software including logic simulation, minimization and an introduction of the use of hardware description language (VHDL/ Verilog HDL). The hands-on assignments will make use of the Xilinx ISE tool chain for the design and implementation of a variety of projects.

#### Course Outcomes

- 1. Analyze and design sequential and combinational systems.
- 2. Assess the performance of a given digital circuit with Mealy and Moore configurations.
- 3. Perform static timing analysis of the digital circuits/systems.
- 4. Design the digital system using VHDL and Compare the performance of a given digital circuits/systems with respect to their speed, number of IC's.

**Mapping of Course Outcomes with Program Outcomes** 

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

<u>Unit-I</u>

Design of combinational circuits and implementation using multiplexers, decoders, ROM, PLA and PAL.

Unit-II 12 hrs

**Synchronous sequential circuits**: The finite state machine, design of single multimode and ring counters, Mealy state diagram, Moore state diagram, state transition tables, state reduction techniques, state assignments, synthesis of sequential circuits.

**ASM modules:** The algorithm state m/c, ASM charts, ASM tables, linking of ASM modules.

Unit-III 12 hrs

**Asynchronous sequential circuits**: Races, hazards, asynchronous, state diagrams, primitive flow tables, state reductions and row merging, design of asynchronous state.

Programmable logic devices: Introduction to CPLDs and FPGAs



Unit-IV 12 hrs

**Introduction to VHDL**: Overview of digital design with VHDL, basic language elements, data objects, classes and data types, operators, overloading, logical operators, VHDL representation of digital design entity and architectural declarations, introduction to behavioural, dataflow and structural models, applications of VHDL to FPGA design.

RECOMMENDED BOOKS										
Title	Author	Publisher								
1. An Engineering Approach to Digital Design	Fletcher William, I	3 <sup>rd</sup> Indian reprint, PHI, (1994).								
2. Digital Design	Morris Mano M	3 <sup>rd</sup> Edition, Pearson Education (2002).								
3. VHDL-Analysis and Modeling of Digital Systems	Navabi Z	McGraw Hill.								
4. Fundamentals of Logic Design	Charles H. Roth Jr	4 <sup>th</sup> Edition, Jaico Publishers (2002).								
5. VHDL for Programmable Logic	Skahill Kevin	1 <sup>st</sup> Indian Reprint, Pearson Education (2004).								
6. Verilog HDL: A Guide to Digital Design and Synthesis	Samir Palnitkar	2 <sup>nd</sup> Edition, Prentice Hall PTR								



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Cours										ntrollers				
<u>Objec</u>	tives	_		on th	e basic	wor	king of	a mic	crocont	roller sy	stem aı	nd its j	prograi	nming
Course			uage.	11 _	.11.			11	1- 14	4	1 1	11.1		
Cours Outco			_		_					ecture and	i embe	aaea pi	ocesso	rs.
Outco	incs				_		s of micr protocol		oner.					
							_		real ti	me applic	rations			
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	DO1	PO2		_	ourse PO5				pogram PO9	outcome		PO12	PSO1	DCO3
CO1	PO1	+	PO3	PO4		2	PO7			PO10	PO11			
COI	2	2	3	3	3	2	2	1	2	0	1	3	2	2
CO2	3	3	2	1	2	0	0	1	2	2	2	3	2	3
CO3	3	3	3 2 2 1 1 1 1 0 1 3 2 3											3
CO4	0	0	0	0	3	3	0	1	3	0	2	2	3	2
		<u> </u>	1	ı		Unit-	·I		I	1	1		1	12 hrs
Intro	duction	: Over	view of	8051 n	nicroco	ntrol	ler famili	es and	l embe	dded syst	em. 4bi	t micro	contro	ller, 8-
bit mi	crocon	roller,	16 bit n	nicroco	ntrolle	r, 32 l	oit micro	contro	oller.					
					<u>]</u>	Unit-	<u>II</u>							12 hrs
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opera	tions, c	ondition	nal and	un-con				basic	progra	mming c	oncepts	·		4.5.1
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uesigi	i exam	ore. Cras	sincan	on or e		Jnit-l		ıı requ	illeu le	n an emo	edded 8	system		12 hrs
Communication devices and protocols: I/O types and examples, serial communication devices, parallel														
devices port, sophisticated interfacing features in device design. serial bus communication protocol,														
parallel bus devices protocol-parallel communication network using ISA, PCI, PCI-X and advanced														
buses														
					RE(	COM	MENDE	ED BO	OKS					
								Auth	or		I	Publish	er	_

RECOMMENDED BOOKS												
Title	Author	Publisher										
1.The 8051 Microcontroller and Embedded	M.Mazidi, JG Maizidi	Pearson Education										
Systems												
2. Embedded Systems	Raj Kamal	Tata McGraw Hill										
3. The 8051 Microcontroller	Kenneth J. Ayala	Pearson Education										

Department of Electronics & Communication

Page 99



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					W	/ireles	s Con	ımuni	cation	1						
				L			T		P			Cred	lits			
				3			0		0			3				
			Sessio	nal M	arks							50	50			
		-	End S	emest	er Exa	minat	tion M	<b>Iarks</b>				50	50			
Cour	rse	,	The ai	im of	this c	course	is to	study	the	basics	of cellu	ılar sys	stems,	impart		
	ctives										will be	•		-		
•				_			-			-			•			
	modulation techniques used for mobile communication and understand the concepts of CDMA and GSM wireless communication standards.															
Cour	Course 1. Understand the concept of cellular system.															
Outc									•		wirele	ss comi	municat	ion.		
				_						_	wireles					
				•					-		s techni					
											nication					
		N								m outc						
	PO1	PO2	PO3	PO4		PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO1	2	2	0	0	1	2	0	1	0	0	3	2	3	2		
603	_	-		1	4	-		4	-		-	-		-		
CO2	1	2	3	3	1	2	0	1	1	2	2	2	2	2		
CO3	3	2	1	2	2	2	1	1	1	1	2	3	2	2		
CO4	2	2	0	0	1	2	0	1	0	0	3	3	3	2		
			1		T	J <b>nit-I</b>	1	<u> </u>	1	1			1	12 hrs		
T4	d., .4! .	. 4 .	1				4			C 11	1	•				

**Introduction to wireless communication systems**: Concept of cellular communication system, basics of wireless cellular system, mobile unit, base station, mobile switching centre, frequency reuse, channel assignment strategies, co-channel interference, determining the frequency reuse distance, hand-off strategies, interference and system capacity, trunking efficiency, improving capacity of cellular system, cell splitting and sectoring.

Unit-II 12 hrs

**Mobile radio propagation**: Introduction to radio wave propagation, free space propagation model, basic propagation mechanisms, reflection, diffraction, scattering, outdoor propagation models, indoor propagation models, signal penetration into buildings, types of small-scale fading, fading effects due to Doppler spread and delay spread, diversity techniques.

Unit-III 12 hrs

**Modulation techniques**: Introduction to linear modulation techniques, minimum shift keying, Gaussian minimum shift keying, spread spectrum modulation techniques, DS-SS, and FH-SS systems, performance of modulation schemes, power spectrum and error performance in fading channels.

<u>Unit-IV</u> 12 hrs

**Wireless communication standards**: Introduction to GSM, GSM services and features, system architecture, radio subsystem and channel types. cellular code division multiple access (CDMA) systems: principle, power control, effects of multipath propagation on code division multiple access and introduction to third generation wireless networks, long term evolution (LTE) and standards.

Department of Electronics & Communication



RECOMMENDED BOOKS												
Title	Author	Publisher										
1.Wireless Communications	T.S Rappaport	Pearson Education, 2003.										
2.Principles of Mobile Communication	Gordon L. Stuber	Springer International Ltd., 2001.										
3. Wireless Communications	Andrea Goldsmith	Cambridge University Press, 2007										



	PCEC-713 Digital Signal Processing Lab													
				Digit	al Sigr	nal Pro	cessing	g Lab						
		]	L			T		P			Credi	ts		
			0			0		2			1			
Course	This la	b aims	to get i	familiar	the stu	idents a	bout th	ne softw	vare M.	ATLAI	3 and it	s use to	verify	
<b>Objectives</b>	various	s mathe	ematica	ıl functi	on i.e	convolu	ition, c	orrelati	ons as	well as	to des	ign of	various	
	digital time causal systems. Later on, Students will learn how to design Low Pass, High													
	Pass, Band Pass and FIR filter with the help of Matlab.													
Course	1. Desi	ign of I	Discrete	e time c	ausal s	ystem.								
<b>Outcomes</b>	2. Veri	fy vario	ous ma	themati	cal ope	erations	with t	he help	of MA	TLAB				
	3. Des	ign of	digital	FIR ar	nd IIR	filters	using	differer	it appr	oaches	and th	eir ass	ociated	
	structu	res.												
	4. Design a filtering algorithm for the real time application.													
	Mapping of Course Outcomes with program outcomes													
PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	

	Mapping of Course Outcomes with program outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	3	3	2	1	0	0	1	3	2	1	1	1	3	
CO2	3	3	3	3	3	0	1	1	3	2	1	1	2	2	
CO3	2	3	3	3	2	1	0	1	3	2	1	2	2	3	
CO4	3	3	3	3	2	1	1	1	3	2	1	2	1	2	

#### **List of Experiments:**

- 1. Write a program in Matlab to generate standard sequences.
- 2. Write a program in Matlab to compute power density spectrum of a sequence.
- **3.** To write a Matlab program to verify correlation and autocorrelation.
- **4.** Write a program in Matlab to verify linear convolution.
- **5.** Write a program in Matlab to verify the circular convolution.
- **6.** To write a Matlab programs for pole-zero plot, amplitude, phase response and impulse response from the given transfer function of a discrete-time causal system.
- 7. Write a program in Matlab to find frequency response of different types of analog filters.
- 8. Write a program in Matlab to design FIR filter (LP/HP) through Rectangular Window technique.
- **9.** Write a program in Matlab to design FIR filter (LP/HP) through Triangular Window technique.
- 10. Write a program in Matlab to design FIR filter (LP/HP) through Kaiser Window technique.
- 11. Write a program in Matlab to find the FFT.
- 12. Implementation of low-pass, high pass and band-pass filter on some chosen signal.



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				0			0		2			1		
Cour	<u>se</u>	This la	ab aims	to get	familiar	ize the	studen	ts abou	it the va	rious c	ommur	ication	antenn	as used
Objec	ctives	in mic	crowave	e range	. It inc	ludes t	heir de	sign, g	gain, dir	ectivit	y, VSV	VR and	variou	is other
		charac	eteristic	s. Furt	her in t	his lab	studer	nts wil	l attain	the kn	owledg	ge abou	it opera	ation of
		variou	ıs Plane	-Tee.										
Cour	1. Evaluate gain, directivity and other antenna parameters.													
Outco	Outcomes 2. Measure the impedance matching characteristics of antennas.													
		3. Ana	alyze th	e perfo	rmance	waveg	guide co	ompon	ents.					
		4. Des	sign an	efficie	nt anten	na for	RF and	micro	wave fr	equenc	y range	e.		
			Mappi	ng of C	Course	Outcor	nes wit	th prog	gram o	utcom	es			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	3	2	0	1	3	2	1	2	1	3
	_	_	_		_	_					_	_		
CO2	02   2   2   3   3   3   2   0   1   3   2   1   2   2   2												2	
CO3	3	3	3	3	2	2	1	1	3	2	1	3	1	3
								_		_				
CO4	3	3	3	2	3	2	2	1	3	2	1	3	2	2
		1									1		I	

#### **List of Experiments:**

- 1. To understand the working of the Motorized antenna trainer.
- 2. To investigate the properties of a Yagi antenna comprising a dipole and a parasitic element.
- 3. To know the form of a Yagi antenna and examine multi element antenna. To see how gain and directivity increase as element numbers increase.
- 4. To investigate the gain, and directivity of the log Periodic antenna over a wide frequency range.
- 5. To plot the radiation pattern of a directional antenna.
- 6. To measure antenna parameters (directivity, gain, beam width, half power beam width, front to back ratio) with polar plot of dipole antenna.
- 7. To measure antenna parameters of monopole antenna.
- 8. To measure antenna parameters of patch array antenna.
- 9. Identification of different waveguide components.
- 10. Study of the characteristics of klystron tube and to determine its electronic tuning range.
- 11. By use of slotted waveguide, to observe how the load impedance affects the VSWR.
- 12. To measure the VSWR of the antenna.
- 13. To determine the frequency & wavelength in a rectangular waveguide working on  $TE_{10}$  mode.
- 14. To be familiar with the operation of directional coupler.
- 15. To determine the standing wave-ratio and reflection coefficient.
- 16. To be familiar with the operation of E Plane-Tee.
- 17. To be familiar with the operation of H Plane-Tee.
- 18. To be familiar with the operation of Magic-Tee.
- 19. Measurement of the gain of horn antenna using Method of the two antennas.
- 20. To measure antenna parameters of horn (E, H, Pyramidal) & open waveguide antenna.
- 21. To measure antenna parameters of conical horn antenna.
- 22. To setup a satellite communication link.



	PREC-711													
Project Stage I and Seminar  L T P Credits														
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Cour	<u>se</u>	To gu	ide the	studer	ıts in sı	ich a w	vay so t	hat the	y carry	out a v	vork on	a topic	as a	
<b>Object</b>	ctives	foreru	inner to	the fu	ll-fledg	ged pro	oject wo	ork to b	e taker	ı subsec	quently	in 7 <sup>th</sup> s	emester.	The
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	from previous courses with the awareness of impact of technology on the society and													
	their ethical responsibilities.													
		2. C	ollect a	nd diss	seminat	te infoi	rmation	relate	d to sel	ected p	roject.			
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		3	3. Unde	erstand	differe	nt topol	logies o	of wirel	ess sen	sor net	works.			
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Department of Electronics & Communication



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		ı	ain and	I		Unit-I	1	1	1		1		1	12 hrs

**Introduction:** Origin and brief history of satellite communication, satellite frequency bands for communication, current state of satellite communication.

**Orbital theory:** Orbital mechanism, locating the satellite in the orbit with respect to earth, look angle determination, azimuth and elevation angle calculations.

<u>Unit-II</u> 12 hrs

**Satellites and satellite link design:** Satellite subsystems, attitude and orbit control system, telemetry, tracking and command (T&C), communications subsystems, transponders, satellite antennas, satellite link design: basic transmission theory, noise figure and noise temperature, design of downlinks, satellite systems using small earth stations, uplink design, design of satellite link for specified (C/N).

Unit-III 12 hrs

**Modulation, multiplexing, multiple access techniques**: FM modulation, analog FM transmission by satellite, S/N ratio for satellite FM video transmission; digital transmission, baseband and bandpass transmission of digital data, digital modulation: BPSK, QPSK; multiplexing: FDM, TDM; access techniques: FDMA, TDMA, CDMA.



<u>Unit-IV</u> 12 hrs

**Propagation effects and satellite services**: Quantifying attenuation and depolarization, atmospheric absorption, cloud attenuation, rain and ice effects, prediction of rain attenuation. VSAT technology, direct broadcast satellite (DBS) for TV and radio, satellite navigation and GPS system, mobile satellite services.

RECOMMENDED BOOKS													
Title	Author Publisher												
1.Satellite Communications	Timothy Pratt, Charles W. John Wiley & Sons, 2002 Bostian, Jeremy Allnutt												
2.Satellite Communications Systems: Systems, Techniques and Technology	Gerard Maral, Michel John Wiley & Sons Ltd. Bousquet 2002												
3. Communication satellite systems	J Martin Prentice Hall publication, 1978												
4.Satellite Communication	Dennis Roddy McGraw-Hill, 4th Edition 2006.												



	PEEC-721C VLSI Circuits															
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			Sessi	onal M	<b>larks</b>							5	50			
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Course O	bjecti	ves	The o	The course aims to present the principles and techniques of CMOS based digital circuit design, connecting digital circuits, logic design, and digital components with												
			circu	it desig	n, coni	necting	digital	l circu	its, logi	e design	, and di	gital cor	nponent	ts with		
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	3. Understand the basics of CMOS fabrication process, its requirements and challenges.															
	4. Calculate and optimize the performance metrics of CMOS circuits.															
4. Calculate and optimize the performance metrics of CMOS circuits.  Mapping of Course Outcomes with program outcomes																
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
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Interconne	ect and	d circu	ıit, Tv	vin-tub	proce	ss, layo	out de	esign	rules ar	nd latch	-up, lat	ch-up t	riggerin	g and		
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					Un	it-IV								8 hrs		
	Circuit characterization and performance estimation resistance and capacitance estimation, Switching															
characteri			gate tr	ansisto	r sizing	g, powe	r dissi	pation	. Basic	physical	design	of simp	ole logic	gates.		
CMOS log	gic stru	icture														
					RE	COMM	IENDI	ED BO	OKS							
		ŗ	Γitle					Auth	or			Publish	er			
1. Desi	1. Design of Analog CMOS Integrated Circuits Behzad Razavi McGraw-Hill															
							L									

Department of Electronics & Communication

Page 108



2. Microelectronics Circuits	Sedra & Smith	Oxford University Press
3. Principles of CMOS VLSI Design	Neil H.E Weste	John Wiley, 1994
4. CMOS Digital Integrated Circuits	Sung-Mo Kang	McGraw-Hill, 2003

Department of Electronics & Communication



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					Fibr	e Opti	cs Con	nmuni	cations					
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familiar with the installation of fibre optics communication network												•		
	application.													
Cours	2 <u>P</u>				of optics	al fiber	and oth	er com	nonent	s for op	tical co	mmiin	ication	system
Outco					-				-	munica			ication	system.
Outco	<u> </u>		•					-			•		nlifion	
			<ul><li>3. Appreciate the long-haul communication achieved by using optical amplifier.</li><li>4. Describe the various optical network topologies.</li></ul>											
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CO3	3	3	2	2	3	0	1	1	2	0	0	3	2	2
CO4	3	3	3	3	2	1	2	1	2	0	3	3	1	1
CO5	3	3	3	3	3	1	0	1	2	0	3	3	2	3
	1	1	1	1		Unit-	<u>I</u>	1	1	1	I			12 hrs

**Introduction to fiber optic**: Historical of fiber optics, block diagram of fiber optical communication, key elements of optical fiber system. standard for optical communication.

**Optical fibers**: Basic optical law and definitions, fiber characteristics and transmission, Types of fibers single mode and multimode, step index and graded index, numerical aperture, modes.

Unit-II 12 hrs

**Attenuation and dispersion**: Attenuation causes and measurement of attenuation, absorption, bending losses, dispersion (intermodal and intermodal), group velocity dispersion, dispersion induced pulse broadening, higher order dispersion, dispersion slope,

**Nonlinear effects**: Stimulated Raman scattering, stimulated Brillouin scattering, cross phase and self-phase modulation, four wave mixing



Unit-III 12 hrs

**Optical source**: Energy bands, intrinsic and extrinsic material, P-n junction, direct and indirect band gaps, LED, structure, material, quantum efficiency, power and modulation, LASER diodes, principle of operation, laser diode rate equations, quantum efficiency, structure and modulation.

**Optical receivers:** Principle of PIN photo detector and avalanche photodiode, photo detector noise, detector response time, RAPD, avalanche multiplication noise, temperature effects, comparison of photo detectors.

<u>Unit-IV</u> 12 hrs

**Optical amplification**: Introduction to optical amplifier, characteristics of semiconductor optical amplifiers (SOAs), Erbium doped fibre amplifiers (EDFAs) and Raman amplifier and their gain characteristics and gain saturation.

**Optical networking**: fibre optics topologies, fibre distributed data interface (FDDI) structure, synchronous optical network (SONET) and SDH, SONET Ring, networking components.

RECOMMENDED BOOKS									
Title	Author	Publisher							
1. Fiber-Optic Communication Systems	G. P. Aggarwal	J. Wiley & Sons. 2 <sup>nd</sup> Ed., 1997							
2. Optic Communication Systems	Mynbaev	Pearson education, 2001,							
3.Optical Fiber Communication	Gerd Keiser	McGraw Hill, 5 <sup>th</sup> edition 2013							
4. Optical Fiber Communication	Senior	PHI							



	PEEC-722B Electronic Measurements and Instrumentation													
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Obje Cour	Course ObjectivesAim of the course is to study the basics of unit, dimensions and standards. It also gives deep insight to PMMC instrument and bridges. It discusses as to how the analog data is converted to digital and vice versa. It also discusses the CRO and 													
			Maj	pping	of Cou	ırse O	utcom	es wit	h Prog	gram O	utcome	s		
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CO2	0	3	2	1	2	2	2	1	0	0	0	2	2	1
CO3	0	3	2	1	2	2	0	1	0	0	1	2	2	1
CO4	0	3	2	1	2	2	2	1	0	0	1	2	2	3
						<u>Unit-l</u>	[							12 hrs

**Unit, dimensions and standards**: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, other unit systems, dimension and standards. measurement errors: gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter.

Unit-II 12 hrs

**Electronic Meters**: Digital voltmeter systems, digital multimeter, digital frequency meter system, voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter.

Unit-III 12 hrs

**Analog to digital converter**: Transfer characteristics, A/D conversion technique: simple potentiometer and servo method, successive approximation method ramp type, integrating and dual slope integrating method. D/A converter: transfer characteristic, D/A conversion technique, digital mode of operation, performance characteristics of D/A convertors.

<u>Unit-IV</u> 12 hrs

**CRO**: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency and phase by CRO, oscilloscope probes, oscilloscope specifications and performance.

**Signal generator, analyser and recorders:** sine wave, non-sinusoidal signal and function generators, frequency synthesis techniques and digital signal generators, spectrum analyzer and distortion, concept of ECG, EMI, EMC, and EEG etc, X-Y recorders, plotters.



RECOMMENDED BOOKS										
Title	Author	Publisher								
Electronic Instrumentation and     Measurements	David A. Bell	2nd Ed., PHI, New Delhi,2008								
2.Electronic Measurements and instrumentation.	Oliver and Cage	TMH, 2009								

Department of Electronics & Communication



							<b>EEC 72</b>							
					Neura	l Netwo	rks and	d Fuzzy	Logics					
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The course will cover a variety of contemporary approaches to neural networks and fuzzy logic for various applications and introduce the underlying principles Fundamental concepts of neural networks and fuzzy logic are covered in detail. Afte taking this course, the student will be ready to understand the structure, design and training of neural network and fuzzy logic based systems and will be competen enough to apply these algorithms for the solution of a wide variety of problems in engineering    Course   Outcomes											nciples.  l. After gn and mpetent lems in rtificial			
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CO2	3	3	2	1	3	2	1	1	1	3	3	3	3	3
CO3	2	3	2	2	2	0	0	1	1	2	2	3	3	3
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<b>N</b> I	1	L	1	4-1-		Unit-I	ı	ı	ı	1		14	1	14 hrs

**Neural network fundamentals**: Artificial intelligence, human brain, neural networks, neuron physiology, artificial neuron model, artificial neural network, artificial neural network architecture, network topologies, ANN parameters, learning methods, supervised learning, unsupervised learning, reinforced learning, competitive learning, delta rule, gradient descent rule, hebbian learning, Rosenblatt's perceptron, ADALINE and MADALINE Networks.

**Unit-II** 12 hrs

Back-propagation networks: Back-propagation network architecture, perceptron model, perceptron learning procedure, single layer artificial neural network, multilayer perceptron model, back-propagation learning, mathematical analysis, learning rate and momentum.

**Unit-III** 

Fuzzy logic: Fuzzy set theory, fuzzy versus crisp, crisp sets, operations on crisp sets, fuzzy set, membership functions fuzzy set operators, crisp relation, cartesian product, operations on relations, fuzzy relations, fuzzy cartesian product, operations on fuzzy relations.

> **Unit-IV** 12 hrs

Fuzzy systems: Propositional logic, propositional logic inference, predicate logic, predicate logic formula, predicate logic inference, fuzzy quantifiers, fuzzy inference, fuzzy rule-based system, defuzzification methods and fuzzy cruise-controller design.



RECOMMENDED BOOKS										
Title	Author	Publisher								
1. Understanding Neural Networks	Stamatios V. Kartalopoulos	Prentice Hall of India								
and Fuzzy Logic		Private Limited, New Delhi,								
		2000								
2. Fuzzy Systems Design	Riza C.	Chand Publishers								
3. Neural Networks, Fuzzy Logics	S. Rajasekaran,	PHI Learning Private								
and Genetic Algorithms (Synthesis	G.A. VijaylakshmiPai	Limited, 2011								
and Applications).										



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<b>Objec</b>	<u>tives</u>	comp	leted	and in	mprov	e per	sonali	ty deve	lopmer	nt and o	commu	nication	skills. T	rain the
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	and time management strategies to their academic studies. Develop audience-centred													
	presentations meeting concrete professional objectives and integrating ethical and legal													
	visual aids. Identify and critically evaluate the quality of claims, explanation, support, and													
	delivery in public and professional discourse, and understand the factors influencing a													
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CO1	3	3	3	3	3	2	3	2	2	2	3	3	1	3
CO2	3	3	3	2	2	1	2	3	2	2	3	0	3	3
CO3	2	2	2	3	2	2	2	3	3	3	3	2	1	2
CO4	3	3	3	3	3	3	0	3	2	3	2	3	1	2
CO5	3	3	3	3	3	2	3	2	2	2	3	3	1	3

# Course Curriculum for Degree Programme in Electronics & Communication Engineering



## **Department of Electronics & Communication Engineering**

Sant Longowal Institute of Engineering & Technology Longowal-148106

Phone: 01672-253117 Fax: 01672-280057

Website: www.sliet.ac.in



#### **VISION**

The Department of Electronics & Communication Engineering shall strive to create engineering technocrats for addressing the global challenges in relevant areas to cater the ever-changing needs of society at National and International level.

#### **MISSION**

- 1. To ensure dissemination of knowledge through effective teaching and learning in Electronics and Communication Engineering.
- 2. To excel in Research and Development activities in emerging areas.
- 3. To promote industry-institute and institute-institute linkages for sustainable development of academic, research, training and placement activities.
- 4. To establish centre of excellence in thrust areas to nurture the spirit of innovation and creativity among faculty and students.



#### **Programme Educational Objectives (PEOs)**

- 1. To be well acquainted with fundamentals of Electronics & Communication Engineering for leading a successful career in industry or as an entrepreneur or pursuing higher education.
- 2. To inculcate rational approach towards constantly evolving technologies with ethical responsibilities.
- 3. To foster techno-commercial skills for innovative solutions in Electronics & Communication Engineering or related areas.
- 4. To participate in life-long learning in the relevant domain for addressing global societal needs.

#### **Programme Outcomes (POs)**

After successful completion of B.E. (Electronics & Communication Engineering) program, the engineering graduates will be able to:

- 1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- 6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.



- 9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **12. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

#### PROGRAM SPECIFIC OUTCOMES (PSOs)

**PSO1:** Ability to participate successfully in competitive examinations, career advancement and higher studies with professional ethics.

<u>PSO2</u>: Ability to solve real world problems in Electronics and Communication Engineering using state of art techniques, along with analytical and managerial skills.



### **B.E.** (Electronics and Communication Engineering)

		Semester-I (Gr	oup-A)								
S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits				
1	BSMA-401	Engineering Mathematics I	3	1	0	4	4				
2	BSPH-401	Applied Physics	3	1	0	4	4				
3	ESEE-401	Elements of Electrical Engineering	2	1	0	3	3				
4	ESCS-401	Elements of Computer Engineering	2	0	0	2	2				
5	ESEC-401	Elements of Electronics Engineering	2	0	0	2	2				
6	BSPH-402	Applied Physics Lab	0	0	2	2	1				
7	ESEE-402	Elements of Electrical Engineering Lab	0	0	2	2	1				
8	ESCS-402	Elements of Computer Engineering Lab	0	0	4	4	2				
9	ESEC-402	Elements of Electronics Engineering Lab	0	0	2	2	1				
		Total	12	3	10	25	20				
	Semester-II A (Group-A)										
S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits				
1	BSMA-402	Engineering Mathematics II	3	1	0	4	4				
2	BSCH-401	Applied Chemistry	3	1	0	4	4				
3	ESME-401	Elements of Mechanical Engineering	2	1	0	3	3				
4	ESME-402	Workshop Technology and Practice	1	0	0	1	1				
5	HSMC-401	English Communication and Soft Skills	1	0	0	1	1				
6	BSCH-402	Applied Chemistry Lab	0	0	2	2	1				
7	ESME-403	Elements of Mechanical Engineering Lab	0	0	2	2	1				
8	ESME-404	Engineering Drawing	0	0	4	4	2				
9	ESME-405	Workshop Technology and Practice Lab	0	0	4	4	2				
10	HSMC-402	English Communication and Soft Skills Lab	0	0	2	2	1				
11	MCCH- 401	Environmental Studies	3	0	0	3	0				
-		Total	13	3	14	30	20				
		Semester-I	T D								

Department of Electronics & Communication

Page 4

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi Surinder Singh



HOWAL W											
Ī		Practical Training During									
	TPIN-421	Summer Vacations (In-house)					1				
	11111 721	02 weeks	0	0	40	40	(S/US)				
		UZ WEEKS	U	U	40	40	1				
	TDIN 422	To share al Commeten are	0	0	40	40	_				
	TPIN-422	Technical Competency	0	0	40	40	(S/US)				
		~									
		Semest	er-III				1				
S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits				
1	BSMA-501	Numerical and Statistical Methods	3	0	0	3	3				
2	PCEC-511	Network Analysis & Synthesis	2	1	0	3	3				
3	PCEC-512	Digital System Design	2	1	0	3	3				
4	PCEC-513	Signals & Systems	2	1	0	3	3				
5	PCEC-514	Electronic Devices & Circuits	2	1	0	3	3				
			2			2					
6	BSBL-501	Biology for Engineers		0	0		2				
7	BSMA-502	Numerical and Statistical Methods Lab	0	0	2	2	1				
8	PCEC-515	Digital System Design Lab	0	0	4	4	2				
		Total	14	03	06	23	20				
	Semester-IV-A										
S.No	Sub Code	Subject Name	L	Т	P	Hrs.	Credits				
1	ESME-501	v	3	1	0	4	1				
		Engineering Mechanics				3	4				
2	PCEC-521	Analog Communication	3	0	0		3				
3	PCEC-522	Analog Electronic Circuits	2	1	0	3	3				
4	PCEC-523	Microprocessor & Microcontroller	3	0	0	3	3				
5	HSMC-501	Principles of Management	3	0	0	3	3				
6	PCEC-524	Analog Electronic Circuits Lab	0	0	4	4	2				
7	PCEC-525	Microprocessor & Microcontroller Lab	0	0	4	4	2				
8	MCMH - 501	Constitution of India	3	0	0	3	0				
	001	Total	17	02	8	27	20				
		1000	<u> </u>	<u> </u>							
		Compostor T	17 D								
	<u> </u>	Semester-I	<b>V-В</b>				1				
	TPID-521	Industrial Training 02 weeks	0	0	40	40	1 (S/US)				
	EAA-521+	Fractional credit course/Extra Academic Activity +GROUP A/B/C	0	0	40	40	1 (S/US)				
		Semester-	VA								
S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits				
10	242 0040	Sasjeet Hame		-	_						

2/2/							
1	PCEC-611	Digital Communication	3	0	0	3	3
2	PCEC-612	EMF & Transmission Lines	3	0	0	3	3
3	OEEC-611	Open Elective-1	3	0	0	3	3
4	OEEC-612	Open Elective-2	3	0	0	3	3
5	PEEC-611	Professional Elective-1	3	0	0	3	3
6	HSMC-601	Technical Communication	2	0	0	2	2
7	PCEC-613	Analog & Digital Communication Lab	0	0	4	4	2
8	HSMC-602	Technical Communication Lab	0	0	2	2	1
		Total	17	0	6	23	20
9*	HDEC-611	Hon's Subject-1					4
10*	HDEC-612	Hon's Subject-2					4

		Semester-	VB									
	EAA-611+	Fractional credit course/Extra Academic Activity +GROUP A/B/C	0	0	40	40	1 (S/US)					
	Semester-VI-A											
S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits					
1	PCEC-621	Linear Integrated Circuits	2	1	0	3	3					
2	PCEC-622	Wireless Communication	3	0	0	3	3					
3	OEEC-621	Open Elective-3	3	0	0	3	3					
4	OEEC-622	Open Elective-4	3	0	0	3	3					
5	PEEC-621	Professional Elective-2	3	0	0	3	3					
6	HSMC-603	Engineering Economics and Entrepreneurship	3	0	0	3	3					
7	PCEC-623	Linear Integrated Circuits Lab	0	0	2	2	1					
8	PCEC-624	MATLAB Programming Lab	0	0	2	2	1					
		Total	17	1	4	22	20					
9*	HDEC-621	Hon's Subject-3					4					
		Semester-V	I-B									
	TPID-621	Industrial Training 04 weeks	0	0	40	40	2(S/US )					
	EAA-622+	Fractional credit course/Extra Academic Activity +GROUP A/B/C	0	0	40	40	1 (S/US)					
	Semester-VII											
S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits					
1	PCEC-711	Digital Signal Processing	3	0	0	3	3					

HO? A													
2	PCEC-712	Antenna and Wave Propagation	3	0	0	3	3						
3	PEEC-711	Professional Elective-3	3	0	0	3	3						
4	PEEC-712	Professional Elective-4	3	0	0	3	3						
5	OEEC-711	Open Elective-5	3	0	0	3	3						
6	PCEC-713	Digital Signal Processing Lab	0	0	2	2	1						
7	PCEC-714	Antenna and Microwave Lab	0	0	4	4	2						
8	PREC-711	Project Stage I and Seminar	0	0	4	4	2						
		Total	15	0	10	25	20						
9*	HDEC- 711	Hon's Subject-4					4						
	Semester-VIII												
S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits						
1	PEEC-721	Professional Elective-5	3	0	0	3	3						
1													
2	PEEC-722	Professional Elective-6	3	0	0	3	3						
2	PEEC-722 PREC-721	Professional Elective-6 Project Stage II	0	0	0 12	3 12	6						
		1		_			_						
		Project Stage II	0	0	12	12	6						
3	PREC-721	Project Stage II  Total	0 <b>6</b>	0	12 <b>12</b>	12 18	6 12						
3	PREC-721	Project Stage II  Total  Hon's Project	0 <b>6</b>	0	12 <b>12</b>	12 18	6 12						
3 4*	PREC-721 PHEC-721	Project Stage II  Total  Hon's Project  OR	0 <b>6</b> 0	0 0 0	12 12 08	12 18 08	6 12 4						
3 4* S.No	PREC-721 PHEC-721 Sub Code	Project Stage II  Total  Hon's Project  OR  Subject Name	0 6 0	0 0 0	12 12 08 P	12 18 08 Hrs.	6 12 4 Credits						
3 4* S.No	PREC-721 PHEC-721 Sub Code INID-721	Project Stage II  Total Hon's Project  OR  Subject Name Internship in Industry	0 6 0 <b>L</b> 0 0	0 0 0 T	12 12 08 P 40	12 18 08 Hrs. 40	6 12 4 Credits 6						
3 4* S.No	PREC-721 PHEC-721 Sub Code INID-721	Project Stage II  Total  Hon's Project  OR  Subject Name  Internship in Industry  Project Stage II	0 6 0 <b>L</b> 0 0	0 0 0 T 0	12 12 08 P 40 12	12 18 08 Hrs. 40	6 12 4 Credits 6 6						
3 4* <b>S.No</b> 1 2	PREC-721 PHEC-721 Sub Code INID-721 PREC-721	Project Stage II  Total Hon's Project  OR  Subject Name Internship in Industry Project Stage II  Total	0 6 0 <b>L</b> 0 0 0	0 0 0 T 0 0	12 12 08 P 40 12 52	12 18 08 Hrs. 40 12 52	6 12 4 Credits 6 6						

<sup>\*</sup>For honour degree only

	Credit Structure of Undergraduate Engineering Program												
S.No	Category	$\mathbf{L}$	T	P	Hrs.	Credits							
1	Humanities and Social Sciences including Management courses	9	0	4	13	11							
2	Basic Science courses	17	4	6	27	24							
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	12	3	18	33	24							
4	Professional core courses	34	5	26	65	52							
5	Professional Elective courses relevant to chosen specialization/branch	12	0	0	12	12							
6	Open subjects – Electives from other technical and /or emerging subjects	15	0	0	15	15							



7	Project work	0	0	12	12	6
8	Seminar/Internship/ Industrial training	0	0	204	204	13
9	Any others [Mandatory Courses and Fractional Credit Courses]	6	0	120	126	3
					Total	160

# <u>List of Professional Electives</u>

Professional Elective-I												
S.No.	Sub Code	Subject Name										
1	PEEC-611A	Pulse and Digital Switching Circuits										
2	PEEC-611B	MEMS										
3	PEEC-611C	Information Theory & Coding										
		Professional Elective-II										
S.No.	Sub Code	Subject Name										
1	PEEC-621A	Control System Engineering										
2	PEEC-621B	Telecommunication Switching Systems & Networks										
3	PEEC-621C	MOS Device Physics & Modelling										
	Professional Elective-III											
S.No.	Sub Code	Subject Name										
1	PEEC-711A	Microelectronics										
2	PEEC-711B	Optoelectronics Devices & Circuits										
3	PEEC-711C	Computer Communication & Networks										
		Professional Elective-IV										
S.No.	Sub Code	Subject Name										
1	PEEC-712A	Microwave & Radar Engineering										
2	PEEC-712B	Computer Architecture & Organization										
3	PEEC-712C	Industrial Electronics										
		Professional Elective-V										
S.No.	Sub Code	Subject Name										
1	PEEC-721A	Wireless Sensor Networks										
2	PEEC-721B	Satellite Communication										
3	PEEC-721C	VLSI Circuits										
		Professional Elective-VI										
S.No.	Sub Code	Subject Name										
1	PEEC-722A	Fiber Optics Communication										
2	PEEC-722B	Electronic Measurement & Instrumentation										
3	PEEC-722C	Neural Networks & Fuzzy Logic										

Department of Electronics & Communication



# **List of Open Electives**

		Open Elective-I						
S.No.	Sub Code	Subject Name						
1	OEEC-611A	Linear Integrated Circuits						
2	OEEC-611B	Digital Electronics						
3	OEEC-611C	Electronic Measurement & Instrumentation						
		Open Elective-II						
S.No.	Sub Code	Subject Name						
1	OEEC-612A	Principle of Communication Engineering						
2	OEEC-612B	Optical Electronics						
3	OEEC-612C	MATLAB Programming						
		Open Elective-III						
S.No.	Sub Code	Subject Name						
1	OEEC-621A	Microprocessor and Applications						
2	OEEC-621B	VLSI Technology						
3	OEEC-621C	Nano Technology						
		Open Elective-IV						
S.No.	Sub Code	Subject Name						
1	OEEC-622A	Biomedical Electronics						
2	OEEC-622B	Control System Engineering						
3	OEEC-622C	Electronic System Design						
		Open Elective-V						
S.No.	Sub Code	Subject Name						
1	OEEC-711A	Digital Systems						
2	OEEC-711B	Microcontroller and Embedded Systems						
		Wireless Communication						



	ESEC-401															
				E	lemen	ts of E	lectron	ics En	gineeri	ng						
				L			T			P		(	Credit	5		
				2			0			0			2			
		Sessi	onal M	arks									50			
		End	Semest	er Exa	minat	tion Ma	arks					50				
Cour	se	The	aim of	this c	course	is to	provide	e an ir	troduc	tion an	d basi	c unde	rstandi	ng of		
Objec	ctives	semio	conduct	or dev	ices v	iz. dio	des, bij	polar ji	unction	transi	stors, j	unction	field	effect		
transistors and operational amplifiers to develop the ability to design basic electron													tronic			
circuits. The course also focuses on knowledge about number systems and logic circuits													rcuits			
		intro	ducing l	basic g	ates ar	nd flip-i	flops.									
Cour	<u>se</u>	1. I	Design s	simple	combi	nationa	al and s	equenti	al logic	c circui	ts.					
Outco	<u>omes</u>	2. (	Characte	erize se	emicon	ductors	s, diode	es and t	ransist	ors.						
		3. A	Apply th	he bas	ics of	diode	and tra	ansistoi	to an	alyse th	he oper	ration (	of elec	tronic		
		d	levices.													
		4. I	Design e	electro	nic circ	cuits su	ch as re	ectifier	s, filter	s, volta	ge regu	ılators,	transis	tor		
		a	mplifie	rs and	operat	ional a	mplifie	rs.								
			Map	ping o	f Cou	rse Ou	tcomes	with p	orogra	m outc	omes					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO1	3	3	1	1	1	3	1	1	0	0	2	1	2	2		
CO2	3	3	3	3	3	2	1	1	0	0	3	2	3	3		
CO3	3	3	0	0	0	0	0	1	0	0	1	0	3	2		
CO4	3	3	3	2	1	3	0	1	0	0	0	0	3	2		
	•	•	•	•	I	Unit-I	•	•	•	•				8 hrs		

**Number system and codes**: Decimal, binary, octal, and hexadecimal number system and their interconversions, Gray code, Excess-3 code.

**Logic gates and flip flops**: Definitions, symbols and truth table of NOT, OR, AND, NAND, NOR, XOR, XNOR gates, De-Morgan's theorems, realization of basic gates using universal gates; realization of simple Boolean equations using universal gates, introduction to K- map (3 variables), logic diagram, truth table and operation of latches and flip flops: RS, T, D, JK.

<u>Unit-II</u> 8 hrs

**Semiconductor devices**: Semiconductor materials: Ge, Si, intrinsic and extrinsic semiconductors, p-type, n-type, p-n junction theory and diodes, its V-I characteristic, equivalent model, diode applications- half wave, full wave and bridge rectifier circuits, filter circuits: inductor filters, capacitor filters, L- section filters,  $\pi$ - section filters, comparison of filters, clippers and clampers, Zener diode, its characteristics and application as a voltage regulator, LED, photodiode.

Unit-III 8 hrs

**Transistors**: Bipolar junction transistor (BJT): basic operation, biasing, concept of dc load line and operating point selection, CB, CE, and CC configurations, BJT as an amplifier and switch, introduction to JFET and MOSFET: construction and operation.

Unit-IV 8 hr

**Operational amplifiers (Op-Amps.)**: Introduction, basic characteristics of ideal and practical Op-Amp, IC741 pin configuration, Op-Amp in different modes: inverting and non-inverting amplifier, basic applications: adder, subtractor, voltage follower, multiplier, differentiator & integrator, instrumentation amplifier.



RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Electronic Devices & Circuits	David A. Bell	Oxford University Press, 5 <sup>th</sup> Edition 2010									
2. Electronic Devices & Circuits	J. Millman & Halkias	McGraw Hill Education 3 <sup>rd</sup> Edition 2010									
3. Electronic Devices & Circuit Theory	Robert L. Boylsted, Louis Nashelsky	Pearson Education									
4.Digital Systems: Principles and Applications	Ronald J. Tocci	PearsonEducation									



	ESEC-402															
				El	ement	s of El	ectron	ics En	gineer	ing Lab	)					
			I			7	Γ	]	P			Credits	}			
			(	)		(	)	2	2			1				
Cours	<u>se</u>	The a	im of t	his lab	is to gi	ve prac	ctical e	xposui	e to stu	udents b	y analyz	zing V-I	charact	eristics		
Objec	ctives	of dif	ferent	semico	nducto	or elect	ronics	device	s and c	lesign of	f basic e	lectroni	c circuit	s. This		
		lab al	lab also includes verification and testing of truth table of various logic gates and flip flops.													
Cours																
	<b>Dutcomes</b> 2. Design practical circuits using semiconductor diodes.															
		3 Analyze various modes of transistors in different configurations.														
		4. De	sign ci	rcuits	using t	ransist	ors and	l Op-A	mps.	_						
			Ma	pping	of Co	urse O	utcom	es wit	h prog	gram ou	tcomes					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO1	3	0	3	3	2	2	0	1	3	2	1	2	1	3		
CO2	3	3	3	3	2	2	0	1	3	2	1	0	1	2		
CO3	3	3	3 0 3 2 2 0 1 3 2 1 2 3													
CO4	3	3	3	3	2	2	0	1	3	2	1	2	2	3		

## **List of Experiments**:

- 1. Verification of the truth tables of basic gates, e.g., 7400, 7402, 7404, 7408, 7432, 7486.
- 2. Design all other gates using NAND and NOR gates.
- 3. Design S-R flip-flop using NOR/NAND gates.
- 4. Verify the truth table of J-K flip-flop (7476), D flip-flop (7474) and T flip-flop.
- 5. To observe and analyze V-I characteristics of PN junction diode.
- 6. To observe and analyze V-I characteristics of Zener diode.
- 7. Design and analysis of half wave rectifier with capacitor filter.
- 8. Design and analysis of center tap full wave rectifier with capacitor filter.
- 9. Design and analysis of bridge type full wave rectifier with capacitor filter.
- 10. Design and analysis of Zener as a voltage regulator.
- 11. To observe V-I characteristic of PNP and NPN transistor in common base configuration.
- 12. Design and analysis of Op-Amp as an inverting amplifier & non-inverting amplifier.
- 13. Design and analysis of Op-Amp as an integrator & differentiator.
- 14. To observe V-I characteristic of JFET.
- 15. To observe V-I characteristic of MOSFET.



	TPIN-421															
					Pr	actical	Train	ing (I	n-hous	e)						
			I	.1		7	Γ	]	P			Credits	5			
			(	)		(	)		0		1 (S/US)					
Cour	<u>se</u>	In-ho	use tra	ining	is imp	arted v	with ar	objec	ctive to	familia	arize an	d provi	de "han	ds on"		
<b>Object</b>	<u>ctives</u>	exper	ience o	on the	requisi	ite tool	ls, com	ponen	ts and	instrum	ents to	be used	in Elec	tronics		
		and 0	Commi	unicati	on Eng	gineeri	ng. Th	e stud	lents w	vill be a	able to	present	their w	ork in		
		writte	en, oral	or for	mal pr	- esentat	ion for	mats.				_				
			written, oral or formal presentation formats.													
Cour		After successful completion of industrial training, the students should be able to  1. understand the use of various tools, electronic components and measuring														
Outco	<u>omes</u>	1.				use of	vario	us too	ols, ele	ectronic	compo	nents a	ind mea	asuring		
				uments		2					_					
		2.								iduals aı			ills.			
		3.								ractical			.•			
		4.								al and w			cation.			
	ı	1								gram ou			ı	T		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO1	3	2	2	2	2	2	2	3	3	3	1	3	3	1		
CO2	3	2	2 3 3 3 3 2 2 3 1 3 1													
CO3	3	3	3 2 3 2 2 2 1 3 1 3 3													
CO4	1	1	1	1	1	1	1	1	3	3	1	3	1	3		



and a	PCEC -511 Network Analysis and Synthesis															
				L	Nei	WOLK 1	Anarys T	ois anu	Synunc	P			Credit	s		
				2			1			0			3	5		
		S	essiona	al Maı	rks	<u> </u>	<del>_</del>		Į.				50			
		E	nd Sei	nester	Exam	inatior	n Marl	KS				50				
Cours	<u>se</u>	N	etwork	analy	t other	courses	s in the									
Objec	Objectives electronics and electrical engineering are based. The main objective of this													se is to		
provide platform to understand analysis of different networks and provide knowledge of													edge of			
	network synthesis.															
Cours	Course 1. Apply basic circuital laws and simplify the network using reduction techniques.													s.		
Outcomes 2. Analyse circuits using Kirchhoff's laws and network simplification theorems.																
	3. Evaluate and compute transient response, steady state response, network functions.											ions.				
						networ	-									
		5.				ks using										
	1	1			_						itcomes	1	ı	1		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO1	3	2	1	2	3	2	0	1	1	0	0	2	3	2		
CO2	2	2	2	2	2	2	0	1	1	0	1	2	3	1		
CO3	1	3	1	3	3	2	0	1	2	0	1	2	3	2		
CO4	3	3	2	3	2	2	0	1	1	0	0	2	3	2		
CO5	3	1	2	3	2	2	0	1	1	0	0	2	2	1		
		•				<u>U</u> 1	nit-I	•	•	•	•	•	1:	2 hrs		

**Basics of circuit analysis**: Two terminal circuit elements (resistor, capacitor and inductor) and their characteristics, ideal voltage and current source, energy concepts in two terminal elements-Delta transformation, Kirchhoff 's Laws, nodal and mesh analysis.

**Network theorems:** Superposition theorem, reciprocity theorem, Thevenin's theorem, Norton theorem, Millman's theorem, maximum power transfer theorem, substitution theorem, compensation theorem, Tellegen's theorem (for both AC and DC excitations).

Unit-II 12 hrs

**Two port networks**: Introduction to single and two port networks, parameters of two port networks such as impedance, admittance, hybrid, transmission, etc. relationship among different parameters, series and parallel connections of two-port networks, conditions for symmetrical and reciprocal networks, duality.

**Resonance and magnetically coupled circuits:** Introduction to resonance, series resonance, parallel resonance, concept of self-inductance and mutual inductance, coupling coefficient, magnetically coupled circuits, simple series and parallel circuits, dot convention, ideal transformer.

Department of Electronics & Communication



<u>Unit-III</u> 12 hrs

**Transient and steady state analysis**: Transients in RL, RC circuits, initial conditions, time constants, concept of phasors, impedance and admittance, analysis of RL, RC and RLC circuits with sinusoidal and driving sources, steady state analysis using phasor, network function: one-port networks and two-port networks, impedance function and admittance function, transfer function, poles and zeros of network functions, restrictions on locations of poles and zeros in driving point functions and transfer functions, review of Laplace transform, solution of network equations using Laplace transform.

Unit-IV 12 hrs

**Network synthesis**: Hurwitz polynomials, positive real functions, synthesis of dissipative networks, Foster and Cauer realization (I, II forms) for LC, RL and RC networks.

**Graph theory:** Concept of network graph, tree, tree branches and links, tie-set and cut-set matrices, introduction to SPICE simulators and MATLAB for solving circuit problems.

RE	COMMENDED BOOKS	
Title	Author	Publisher
1. Fundamentals of Electric Circuits	Charles K. Alexander and Matthew N.O. Sadiku	Tata McGraw Hill
2. Engineering Circuit Analysis	William H. Hayt and Jack Kemmerly	Tata McGraw Hill
3. Network Analysis	Van Valkenburg	Prentice Hall of India
4. Circuit and Networks: Analysis and Synthesis	A.Sudhakar and S.Palli	Tata McGraw Hill
5. Networks and Systems	D. Roy Choudhary	New Age International



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					Digita	l Syste	m Des	sign							
		L		T			P				C	redits			
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	Sessional	l Marks	S						50						
	End Sem	ester E	xamin	ation	Marks	S			50						
Course	This cou	rse pro	vides	a mod	lern in	trodu	ction t	o logi	gic design and the basic building blocks						
<b>Objectives</b>	used in d	used in digital system. The course deals with sequential circuits, random access memories,													
	and mod	nd modern logic devices such as field programmable logic gates. State machines will then e discussed and illustrated through case studies of more complex systems using													
	be discu	issed a	nd ill	lustrat	ed th	rough	case	studi	es of	more	com	plex	systems	using	
	program	mable l	ogic d	levice	s.	_						-			
Course		orogrammable logic devices.  . Analyse and design sequential and combinational systems.													
Outcomes	2. Asses										and M	Ioore o	configu	rations.	
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	4. Desig			_	•		_		•			nce of	a given	digital	
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CO2	3	3	2	1	1	1	2	1	1	0	3	2	3	2	
CO3	3	3	3	3	2	2	2	1	1	0	3	2	3	3	
CO4	3	3	3	1	3	2	2	1	1	0	3	2	2	3	
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**Basics of Digital System:** Review of number system, Boolean expressions and their minimization using K-map, logic gates, Combinational circuits: Ripple carry adder, BCD, High speed adder, Subtractor, Code conversion, Magnitude comparators, Applications of Encoders, Decoders, MUX, DEMUX, Implementations using ROM, PLA, PAL. Standard ICs and their applications. Using combinational modules to design digital systems

<u>Unit-II</u> 16 hrs

**Sequential Circuits:** Various types of latches and flip-flops and their conversions, Universal Shift Registers, Counters – Ring, Johnson, Design of synchronous and Asynchronous Counters, Timing issues, Setup and hold times, operating frequency limitations, Static Timing Analysis, Standard ICs for their applications, Finite State Machines – Moore and Mealy, Design of Synchronous and Asynchronous sequential circuits, Races and hazards, hazard free design.

Unit-III 12 hrs

**Introduction to VHDL**: Overview of digital system design with VHDL, basic language elements, data objects, classes and data types, operators, overloading, logical operators, VHDL representation of digital design entity and architectural declarations, introduction to behavioural, dataflow and structural models, applications of VHDL to design.

Unit-IV 8 hr

**Digital logic families**: Characteristics of digital circuits: fan in, fan-out, power dissipation, propagation delay, noise margin, transistor-transistor logic (TTL), types of TTL gates, tristate logic & its applications, emitter coupled logic (ECL), CMOS, comparison of characteristics of TTL, ECL, and CMOS, interfacing of logic families.



Semiconductor memories: Memory organization, ROM, PROM, EPROM, EEPROM, RAM, Static RAM, Dynamic RAM cell, memory cell, reading & writing operation in RAM.

RECOMM	ENDED BOOKS	
Title	Author	Publisher
1. An Engineering Approach to Digital	Fletcher William, I	3 <sup>rd</sup> Indian reprint, PHI,
Design		(1994).
2. Digital Design	Morris Mano M	3 <sup>rd</sup> Edition, Pearson
		Education (2002).
3. VHDL-Analysis and Modeling of Digital Systems	Navabi Z	McGraw Hill.
4. Fundamentals of Logic Design	Charles H. Roth Jr	4 <sup>th</sup> Edition, Jaico Publishers
		(2002).
5. VHDL for Programmable Logic	Skahill Kevin	1 <sup>st</sup> Indian Reprint, Pearson
		Education (2004).
6. Verilog HDL: A Guide to Digital Design	Samir Palnitkar	2 <sup>nd</sup> Edition, Prentice Hall
and Synthesis		PTR

Department of Electronics & Communication Page 17



PCEC-513														
							als &		ms					
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		Sessi	onal N	<b>Iarks</b>									50	
		End	Semes	ter Ex	amina	tion N	Marks						50	
This course aims to provide detailed description of continuous and discrete-time sign and systems, their properties, representations, and methods that are necessary for analysis of continuous and discrete-time signals and systems. Knowledge of time domain and frequency-domain representation and analysis using Fourier series at Transforms, Laplace-transform, to understand principles of random signals and random processes.    Course   Outcomes									for the time-es and andom y used ystems ysis.					
		<del>4.</del> 01									m varia utcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	1	1	1	1	0	0	2	3	3
CO2	3	2	2	2	3	1	1	1	1	0	0	2	3	3
CO3	3	2 2 2 3 1 1 1 1 0 0 2 3 2												
CO4	3	3	2	2	2	1	1	1	1	0	0	2	3	2
<u>Unit-I</u> 12 hrs  Introduction: Definition of signals and systems, elementary signals, classification of signals and														
Intro	ductio	n: Def	inition	of sig	mals a	nd svs	stems.	eleme	ntary s	signals.	classifi	cation of	of signa	ls and

**Introduction**: Definition of signals and systems, elementary signals, classification of signals and systems, properties of systems.

LTI systems: Continuous-time and Discrete-time LTI systems, their properties.

Unit-II 12hrs

**Fourier series representation of signals**: Fourier series representation of continuous-time and discrete-time periodic signals, properties of continuous-time and discrete-time Fourier series.

**Fourier transform**: Continuous-time Fourier transform of periodic and aperiodic signals, properties of continuous-time Fourier transform, discrete-time Fourier transform of periodic and aperiodic signals, convolution.

Unit-III 12 hrs

**Laplace transform** (**LT**): One-sided Laplace transform (LT) of common signals, important theorems, and properties of LT, Inverse LT, solutions of differential equations using LT, bilateral LT, region of convergence (ROC).

**Z-Transform:** Z-Transform and its properties, Region of convergence and its properties, inverse z transform, transfer function, causality and stability, Unilateral Z-Transforms.

Unit-IV 12 hrs

**Random signal theory**: Concept of probability, random variables, commutative distribution function, probability density function (PDF), average value and variance of random variables, Gaussian (PDF),

Department of Electronics & Communication



Rayleigh (PDF), mean, variance and PDF of the sum of random variables, correlation between two random variables.

**Random processes**: Introduction, classification, correlation, and auto correlation, stationary andergodic process.

RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Signals and Systems	Alan V. Oppenheim, Alan S. Willsky	Pearson Education Limited, (2013)									
2. Signal Processing and Linear Systems	B P Lathi	Oxford University Press, (2003)									
3. Signals and Systems	T. Rawat	Oxford University Press, (2010)									
4. Signals and Systems	Simon Haykin, Barry Van Veen	John Wiley & Sons, (2007)									

Department of Electronics & Communication

Page 19



	PCEC-514 Electronic Devices & Circuits																	
				L			T		Circu	P			Credits	3				
		F		2			1			0			3					
			Session	nal Ma	ırks								50					
			End Semester Examination Marks 50															
Cour	<u>'se</u>		The objective of this course is to familiarize with semiconductors device										evices.					
Obje	ctives		Qualitative analysis of PN junction diode and introduction to special purpos										urpose					
			diodes. To study and analyze the performance of BJT, FETs, UJT on the basis of											asis of				
	their operation and principle of working.																	
Cour	Course 1. Acquire knowledge about semiconductor physics for intrinsic and extrinsic												trinsic					
Outc	<u>vutcomes</u> materials and their properties.																	
2. Understand basics of various semiconductor diodes, BJTs and their qualitat										litative								
			and c	<sub>l</sub> uantita	ative a	nalyse	s.											
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			4.Unde	erstand	and a	nalyze	specia	ıl purp	ose dio	odes and	d their a	application	ons in n	nodern				
			circu															
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CO1	3	3	1	1	1	1	1	1	1	0	0	2	3	2				
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CO3	3	3	2 3 1 1 2 1 1 0 0 2 3 2															
CO4	3	3	1 2 1 1 2 1 0 0 2 3 2															
	Unit-I 12 hrs																	
Semi	condu	Semiconductor physics: The energy hand theory in crystal, charge carriers in semiconductors, carrier																

**Semiconductor physics**: The energy band theory in crystal, charge carriers in semiconductors, carrier concentrations, Fermi level, electron and hole concentration at equilibrium, carrier drift and diffusion, conductivity and mobility, carrier lifetime, Poisson's and continuity equation, Hall effect.

Unit-II 12 hrs

**The P-N junction theory**: P-N junction equilibrium condition, contact potential, equilibrium Fermi level, electric field, space charge at junction, qualitative theory of P-N junction, P-N junction as a diode, diode equation, volt-ampere characteristics, temperature dependence of V-I characteristic, diode models, depletion and diffusion capacitance, junction breakdown mechanism, diode switching characteristics.

**Special purpose devices**: Varactor diode, Tunnel diode, Schottky barrier diode, LED, photodiode, SCR.

<u>Unit-III</u> 12 hrs

**Bipolar junction transistor (BJT)**: Device structure and physical operation, transistor current components, modes of operation, common emitter, common base and common collector configurations, input, output characteristics, BJT specifications, DC and AC load line, DC operating point, DC Biasing circuits-fixed bias, emitter bias, voltage divider bias, voltage feedback, Bias stability, Stabilization against variation in Ico, VBE and β, Bias compensation.



Unit-IV 12 hrs

**Junction field effect transistor**: Basic n channel and p channel JFET operation, its V-I characteristics.

**Metal oxide semiconductor field effect transistor**: MOS Capacitor. Energy band diagram for MOS capacitoor with p-type and n-type substrate, Space charge width, work function difference, flat band voltage, threshold voltage, Differential charge distribution, C-V charactristics for MOS capacitor, MOSFET structure and its classification and V-I charactristics of MOSFET.

RECOMMENDED BOOKS										
Title	Author	Publisher								
1.Semiconductor Physics and Devices	Donald A. Neamen	Tata McGraw-Hill								
2. Electronic Devices & Circuits	J. Millman & C Halkias	McGraw Hill Education 3 <sup>rd</sup> Edition 2010								
3.Microelectronic Circuits	Adel S. Sedra, Kenneth C. Smith	Oxford Press 6 <sup>th</sup> Edition 2013								
4. Solid State Electronics Devices	Ben G Streetman & Sanjay Banerjee	PHI 6 <sup>th</sup> edition, 2013								



PCEC-515														
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Cour	<u>se</u>	The aim of this lab is to verify and design of basic digital electronics circuits. It includes											cludes	
Obje	ctives	designing and testing of combinational circuits, sequential circuits, digital logic											logic	
		families and programmable logic devices.												
Cour	se 1.Analyze and implement various logic gates and Boolean functions.													
Outc	omes													
		3.Design and analyze sequential digital circuits.												
		4.De	sign n	nemori	es and	progra	ammal	ole log	ic devi	ices.				
			Map	pping	of Cou	ırse O	utcom	es wit	h Prog	gram O	utcome	S		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	2	1	0	1	3	2	1	2	2	3
CO2	2	3	3	3	2	1	2	1	3	2	1	2	2	3
COZ	۷													
CO3	2	3	3	3	2	3	0	1	3	2	1	2	2	3
CO4	2	1	3	3	2	3	2	1	3	2	1	2	2	3

## **List of Experiments:**

### **PART-A**

- 1. Introduction to Digital Electronics lab-nomenclature of digital ICs, specifications, study of the datasheet, concept of  $V_{cc}$  and ground.
- 2. To verify De-Morgan's Theorem and Implementation of the given Boolean function using logic gates in both SOP and POS forms.
- 3. To realize half/full adder and half/full subtractor using basic/universal gates.
- 4. To realize parallel adder/subtractor using IC 7483.
- 5. To verify BCD to excess-3 code conversion using NAND gates.
- 6. To convert Gray code to binary number and binary number to Gray code.
- 7. Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates. To implement the arithmetic circuits half adder, half subtractor, full adder and full subtractor using multiplexers.
- 8. To design and verify the operation of magnitude comparator.
- 9. Verification of state tables of RS, J-K, T and D Flip-Flops using NAND Gates with timing diagrams.

\*Experimentation work to be supported by simulated results



#### **PART-B**

- 1. To design and implement a circuit for a 2 bit parallel adder using NAND gates only.
- 2. To design and implement the 4-bit synchronous counter.
- 3. To design and implement the 4-bit asynchronous counter.
- 4. VHDL code for Half/Full adder.
- 5. VHDL behavioral description of 4-bit ALU. The circuit performs two arithmetic and two logical operations that are selected by 2-bit input. The four operations are ADD, SUB, AND and OR.
- 6. VHDL program to count number of one's in 10-bit binary number.
- 7. VHDL code for 8:3 encoder.
- 8. VHDL code for positive edge triggered T-flip flop.
- 9. VHDL code for 8-bit SISO shift register.
- \*Experimentation work to be supported by simulated results



PCEC-521 Analog Communication														
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		F		<u>L</u>					P			Cred 3	IIIS	
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			Sessional Marks 50 End Semester Examination Marks 50											
Course Objecti	<u>Course</u> <u>Objectives</u> The course emphasizes on the use of essential analytical tools and theories of analog communication systems, understand various analog communication techniques, AM, FM transmission and reception circuits, analog pulse modulation techniques and noise in communication systems.													
Course 1. Gain knowledge about the fundamental concepts of various analog														
	Outcomes communication systems.													
	2. Design the AM, SSB, FM and PM transmission and reception circuits.													
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				•	-		nd PPM	-		1	3		,	
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CO1	3	2	1	1	2	2	2	1	0	0	2	2	3	2
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соз	3	3	1 1 2 2 1 0 0 0 2 3 3											
CO4	3	3	3 3 2 2 1 0 0 0 2 3 2											
	Unit-I 12 hrs													

Analog modulation techniques: Introduction to modulation, need of modulation, theory of amplitude modulation, frequency spectrum of AM wave, AM power calculations, AM modulation with a complex wave, concepts of angle modulation, theory of frequency modulation, mathematical analysis of FM, spectra of FM signals, narrow band FM, wide band FM, phase modulation, phase modulation obtained from frequency modulation, comparison of AM, FM and PM.

Unit-II 12 hrs

AM Transmission/AM Reception: Introduction, Generation of Amplitude Modulation, Basic Principles of AM Generation; Square law Diode Modulation, Vander Bijl Modulation, Suppressed Carrier AM Generation, Ring Modulator, Balanced Modulator. Tuned Radio Frequency (TRF) Receiver, Basic Elements of AM Super-heterodyne receiver; RF Amplifiers Characteristics, Sensitivity, Selectivity, Image Frequency Rejection, Mixers Tracking and Alignment, Local Oscillator, IF Amplifier, AM Detectors; Envelope or Diode Detector, AGC, AM Receiver using Transistors Communication Receiver.

FM Transmission/FM Reception: Generation of FM by Direct Methods. Indirect Generation of FM;
The Armstrong Method, FM Stereo Transmission. FM Receiver Direct Methods of Frequency
Demodulation; Slope Detector, Travis Detector, Foster Seely or Phase Discriminator, Indirect methods of FM Demodulation; FM Detector using PLL and Stereo FM Multiplex Reception.

Unit-IV 12 hrs

Department of Electronics & Communication

Page 24



**SSB Transmission/SSB Reception:** Advantages of SSB transmission, Generation of SSB; Independent Side-Band Systems (ISB), Vestigial Side-Band Modulation (VSB), SSB Product Demodulator, Balanced Modulator as SSB Demodulator, ISB/Suppressed Carrier receiver.

**Pulse Modulation Transmission and Reception:** Introduction, Pulse Amplitude Modulation (PAM), PAM Modulator Circuit, Demodulation of PAM Signals, Pulse Time Modulation (PTM); Pulse Width Modulation (PWM), Pulse Position Modulation (PPM).

RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Electronic Communication Systems	Kennedy, G.	Tata McGraw-Hill (2008) 4 <sup>th</sup> ed									
2. Communication Systems	Haykin, S.	John Wiley & Sons (2009) 4 <sup>th</sup> ed.									
3. Principles of Communication Systems	Taub, H&Schilling	John Wiley & Sons									
4. Electronic Communication Systems	Wayne Tomasi	Pearson Education (2011), 5 <sup>th</sup> ed									



PCEC-522															
					A	nalog l	Electro	onic C	ircuits	<b> </b>					
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			ional N									50			
		End	Semes	ster Ex	kamina	ation N	Marks						50		
Cour	<b>Course</b> To study the transistor behaviour at low and high frequency and analyze the behaviour											aviour			
Objectives of multistage amplifier by coupling in different ways. To study different feedback															
configurations, oscillators, power amplifiers and tuned amplifiers.															
Course 1. Analyze the low and high frequency response of BJT, MOSFET.															
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			_		·	_		_	-		niques.	-			
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CO2	3	3	3	2	1	2	0	1	0	0	0	2	1	2	
CO3	3	3 2 3 1 2 2 1 0 0 1 2 3 2													
CO4	3	3	2	2	1	2	1	1	0	0	1	2	3	2	
<b>~</b>	<u>Unit-I</u> 12 hrs														

**Single stage BJT amplifiers**: Analysis of transistor amplifier circuit using h-parameters, CE amplifier, CB amplifier, emitter follower and comparison.

**Single stage MOS amplifiers:** Small signal operation and model, CS amplifier, CG amplifier and source follower and comparison. BJT current mirrors and MOS current mirrors circuits and their analyses.

Unit-II 12 hrs

**Multistage amplifier**: Multi-stage amplifier gain, effect of loading, types of coupling, direct and RC coupled amplifiers, frequency response of a BJT and FET amplifier, cut-off frequencies and bandwidth, cascode amplifiers- MOS cascode, BJT cascode, cascode current source, double cascoding, folded cascode, Darlington amplifier.

**Transistor at high frequencies**: High frequency model of BJT and frequency response of CE amplifier, gain-bandwidth product, Miller's theorem, MOSFET at high frequency, common source amplifier at high frequencies, analysis using Miller theorem.

Unit-III 12 hrs

**Feedback amplifiers**: Properties of negative feedback, four basic feedback topologies, analysis of current-series, current-shunt, voltage-series and voltage-shunt feedback amplifiers.

**Oscillators**- The oscillation criteria, Wien bridge, phase shift, LC tuned oscillators, crystal oscillators, astable multivibrator.



<u>Unit-IV</u> 12 hrs

**Output stages and power amplifiers**: Classification of output stages, analysis of class-A output stage, class-B output stage, class AB output stage, class C output stage, harmonic distortion.

**Tuned amplifiers**: Basic principle, inductor losses, amplifiers with multiple tuned circuits, synchronous and stagger tuning, class C tuned amplifier.

synchronous and stagger tuning, class C tuned amplifier.										
RECOMMENDED BOOKS										
Title Author Publisher										
1.Microelectronic Circuits	Adel S. Sedra, Kenneth C. Smith	Oxford 2013	Press 6 <sup>th</sup>	Edition						
2. Integrated Electronics	Millman & Halkias	Tata Educati	McGraw on	-Hill						
3. Electronics devices and circuit theory	Robert L Boylestad & Louis Nashelsky	Pearson	Education							



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		8085 &	-		pt of sc	Tiai co	mini	cation	and n	пспасп	ing the C	Attital	ucvices	with the	
		0005 6	Mapping of Course Outcomes with Program Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8			PO11	PO12	PSO1	PSO2	
CO1	3	3	3	1	2	2	1	1	0	0	2	2	2	3	
CO2	3	3	2	1	1	2	2	1	0	0	3	2	3	3	
CO3	3	3	3	3	2	2	2	1	0	0	3	2	3	3	
CO4	3	3	3	2	3	2	2	1	0	0	3	1	2	3	
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memor	y, inpu	t / outpi	ut, inter	rfacing	devices	s MPU									
Progra	mmin	g using	8085	microp	rocess	or: Ins	truction	n set o	of 808	5 micro	proces	sor, Ad	dressing	modes,	
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						<u>nit-III</u>							2 hrs		
Introduction to 8051 microcontrollers & Programming using 8051 microcontroller: Pin description and architecture of 8051 microcontroller, arithmetic, logic and single bit instructions, addressing modes. I/O															
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8031.C	8051.Comparison of Microprocessor and Microcontroller, micro controller and embedded processors.														

**Unit-IV** 

12 hrs



## **Interfacing with External Devices:**

Introduction to 8155/8156,8255 A programmable peripheral interface, 8253/8254 programmable interval timers, 8259 a programmable interrupt controller, 8251 USART.

8051 connection to RS 232, Serial communication programming, Interfacing of 8051 microcontroller- LCD, ADC and DAC, Stepper motor.

RECON	MMENDED BOOKS					
Title	Author	Publisher				
1.Microprocessor Architecture- Programming & Applications with 8085/8080A	Ramesh S Gaonkar	5 <sup>th</sup> Edition, Penram International Publishing				
2.Introduction of Microprocessors & Microcomputers	Ram B	4 <sup>th</sup> Edition, Dhanpat Ra Publisher (P) Ltd.				
3.The 8051 Microcontroller and Embedded Systems	M.Mazidi, JG Maizidi	Pearson Education				
4. An introduction to Intel family of Microprocessors	James L Antonakes	3 <sup>rd</sup> Edition, Pearson Education				
5.The 8051 Microcontroller	Kenneth J. Ayala	Pearson Education				



Analog Electronics Circuits Lab  L T P C  O O 4  Course Objectives ORCAD spice simulator. It also includes the study of response of multista various coupling techniques. Further in this lab student will observe the fre various amplifiers.  Course Outcomes 1. Analyze the frequency response of various coupling amplifiers. 2. Analyze the frequency response of FET amplifier. 3. Analyze the class A, B amplifiers and tuned voltage amplifier.	PCEC-524													
Course Objectives This lab includes the analysis of analog electronic circuits using hardwar ORCAD spice simulator. It also includes the study of response of multista various coupling techniques. Further in this lab student will observe the fre various amplifiers.  Course Outcomes Outcomes Outcomes Outcomes														
Objectives         ORCAD spice simulator. It also includes the study of response of multistal various coupling techniques. Further in this lab student will observe the frequency amplifiers.           Course         1. Analyze the frequency response of various coupling amplifiers.           Outcomes         2. Analyze the frequency response of FET amplifier.	Credit	ts												
Objectives         ORCAD spice simulator. It also includes the study of response of multistal various coupling techniques. Further in this lab student will observe the frequency amplifiers.           Course         1. Analyze the frequency response of various coupling amplifiers.           Outcomes         2. Analyze the frequency response of FET amplifier.	2													
various coupling techniques. Further in this lab student will observe the fre various amplifiers.  Course Outcomes  2. Analyze the frequency response of Various coupling amplifiers. 2. Analyze the frequency response of FET amplifier.	re kits	as wel	l as on											
various amplifiers.  Course 1. Analyze the frequency response of various coupling amplifiers.  Outcomes 2. Analyze the frequency response of FET amplifier.														
<ul> <li>Course</li> <li>Outcomes</li> <li>Analyze the frequency response of various coupling amplifiers.</li> <li>Analyze the frequency response of FET amplifier.</li> </ul>	equen	cy resp	onse of											
Outcomes 2. Analyze the frequency response of FET amplifier.	various amplifiers.													
	1. Analyze the frequency response of various coupling amplifiers.													
3. Analyze the class A, B amplifiers and tuned voltage amplifier.	2. Analyze the frequency response of FET amplifier.													
4. Design various feedback and oscillator circuits.														
Mapping of Course Outcomes with Program Outcomes														
PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 F	PO12	PSO1	PSO2											
CO1         3         2         3         2         1         1         3         2         1	2	2	1											
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CO3         3         2         2         3         1         2         1         1         3         2         1	2	1	1											
CO4         3         2         2         3         2         1         1         3         2         1	2	1	2											

### **List of Experiments:**

Note: Experiments based upon hardware using hardware kits and rest using simulation with the help of simulation packages

- 1. To measure the h-parameters of CE configuration.
- 2. To determine the voltage gain of a two stage RC coupled amplifier.
- 3. To plot frequency response characteristics of Transformer coupled amplifier.
- 4. To plot frequency response characteristics of direct coupled amplifier.
- 5. To study the gain and frequency response of CS FET amplifier.
- 6. To plot frequency response of a tuned voltage amplifier and to calculate its resonant frequency.
- 7. To study the double ended tuned amplifier.
- 8. To study the class A power amplifier and find its efficiency.
- 9. To study the class B power amplifier and find its efficiency.
- 10. To study the cascode amplifier.
- 11. To study the concept of feedback in voltage amplifier.
- 12. To study the RC phase shift oscillator and measure its frequency of operation.
- 13. To study the LC oscillator and measure the frequency of operation.
- 14. To plot the frequency response of a Darlington amplifier. Calculate gain and bandwidth.
- \*Compare the results of each aim of experiment with ORCAD spice simulation.



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<b>Object</b>	<u>ctives</u>	device	s. It	include	es vari	ous p	rogram	s to p	erform	n speci	fic task	ks i.e. a	ddition,	sorting,	
		multip	licatio	n and 1	many n	nore. S	tudent	s will t	e inter	face mi	icroproc	cessor 80	)85 kit to	various	
	peripheral devices such as RS-232C, 8155/8255.														
Cours	rse 1. Perform various arithmetic and sorting operations with the help of microprocessor.														
Outco	<u>omes</u>	2. Interface 8155/8255 with 8085 and 8051.													
		3. Interface with various peripheral devices such as external keyboard, printer, 8253, personal													
		co	mputer	s using	RS23	2C.									
		4. Im	pleme	nt seria	l comn	nunicat	tion an	d interf	ace ext	ternal d	evices v	with 8085	5 and 80:	51	
			M	[appin	g of Co	ourse (	Outcon	nes wit	h Prog	gram O	utcome	es			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
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CO2	3	3	2	2	1	2	1	1	3	2	1	2	3	3	
CO3	3	3	3	3	2	2	1	1	3	2	1	2	3	3	
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## **List of Experiments:**

### **PART-A**

- 1. 2's compliment of 8-bit number.
- 2. 2's compliment of 16-bit number.
- 3. Program to shift a block of data from one memory location to another.
- 4. Multiplication by two, employing bit rotation.
- 5. Addition of two 16-bit numbers.
- 6. Interface ADC chip with microprocessor kit and verify its operation.
- 7. Interface DAC chip with microprocessor kit and verify its operation.
- 8. Interface an external 8253/8254 to the microprocessor kit at the address given. Hence,
  - a) generate a pulse train of specified duty cycle at the given output line,
  - b) operate as a: N counter,
  - c) Count a train of pulses for a given duration.
- 9. Interface seven segment display through 8279.
- 10. Use the SOD line to generate a square wave of the specified duty cycle at a given frequency.



### **PART-B**

- 1. Write a program to toggle all the bits of port 1 by sending to it the values 55H and AAH continuously. Put a time delay in between each issuing of data to port 1.
- 2. Multiply 25 by 10 using the technique of repeated addition.
- 3. Write a program to add the first 10 natural numbers.
- 4. Write a program to add two BCD numbers.
- 5. Write a program to perform the subtraction of two numbers.
- 6. Write a program to perform the division of two numbers.
- 7. Write a program using 8051 to split a byte into two nibbles and show results.
- 8. Create a square wave that has a high portion of 1085  $\mu$ S and a low portion of 15  $\mu$ S. Assume XTAL = 11.0592 MHz Use Timer 1.
- 9. Write the following programs:
  - a) Create a square wave of 50% duty cycle on bit 0 of port 1.
  - b) Create a square wave of 66% duty cycle on bit 3 of port 1.
- 10. Assuming XTAL =22 MHz, write a program to generate a pulse train of 2 seconds period on pin P2.4. Use Timer 1 in mode 1.
- 11. Design a counter for counting the pulse of an input signal. The pulse to be counted is fed to pin3.4. XTAL = 22MHz.
- 12. Design a circuit to interface ADC with microcontroller.
- 13. Design a circuit to interface DAC with microcontroller.
- 14. Design a circuit to interface LCD with microcontroller.
- 15. Design a circuit to interface keyboard with microcontroller.



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					Inc	dustria	ıl Trai	ning (2	2 week	(s)					
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<b>Object</b>	<u>ctives</u>	envir	onmen	t and e	nhance	their k	knowle	dge sk	ills tov	vards de	velopin	g a holis	tic pers	pective	
		to un	understand various practical issues and latest trends in the field. The students will be												
		able t	ble to troubleshoot various engineering faults related to their respective fields. They will												
		be ab	be able to learn ethical management practices.												
Cour	<u>se</u>	After	After successful completion of industrial training, the students should be able to												
Outco	omes	1: im	1: implement the technical skills as an individual and in team.												
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CO2	3	2	3	3	3	3	3	2	2	3	1	3	3	1	
CO3	3	3	2	3	2	2	2	2	1	3	1	3	3	3	
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		modi	ulation	techni	ques.								various	digital
Cours	<u>e</u>									munic	ation sy	ystem u	ıseful	
Outco	mes							ications						
		2. Gain knowledge about various data formats for digital data transmission.												
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CO2	3	2	2	3	3	2	1	1	1	0	1	2	3	3
CO3	1	2	1	2	1	2	1	1	0	1	1	1	3	3
CO4	3	3	2	2	3	2	1	1	1	0	1	2	3	3
CO5	3	3	3	2	2	2	0	1	1	0	2	2	3	3
					]	Unit-I						1	2 hrs	

**Elements of digital communication system**: Block diagram of digital communication system, digital representation of analog signals, advantages and disadvantages of digital communication system, noisy communication channels, information and entropy.

**Pulse code modulation:** Sampling theorem for baseband and band pass signals, aliasing, signal recovery through holding, quantization of signals, quantization error, uniform and non-uniform quantization, dynamic range, A-law and  $\mu$ -law companding, pulse code modulation (PCM), differential pulse code modulation (DPCM), need of predictor, delta modulation (DM), adaptive delta modulation (ADM), comparison of PCM, DPCM and DM.

<u>Unit-II</u> 12 hrs

**Line coding schemes**: Power spectral density (PSD) of sequence of random pulses, power spectral density of digital data, introduction to line codes and its properties, unipolar, polar and bipolar signalling formats, NRZ& RZ modulation formats, ON-OFF signalling, AMI and Manchester coding and their power spectra, comparison among various line codes, pulse shaping.



<u>Unit-III</u> 12 hrs

**Digital modulation techniques:** Digital modulation formats, binary amplitude shift keying (BASK) modulator, coherent and non-coherent ASK detection, binary phase shift keying (BPSK) transmitter, coherent BPSK detection, differential PSK, quadrature phase shift keying modulation (QPSK) transmitter and receiver, offset QPSK, M-ary BPSK, quadrature amplitude modulation (QAM), binary frequency shift keying (BFSK) transmitter, non-coherent FSK detector, coherent FSK detector, M-ary FSK, minimum shift keying (MSK) and Gaussian minimum shift keying (GMSK), power spectral analysis and comparison of signal constellations for digital modulation techniques.

Unit-IV 12 hrs

**Optimal reception of digital signal:** Introduction, baseband signal receiver, probability of error for the baseband signal, optimum receiver for baseband and bandpass signals, optimum filter transfer function, matched filter and its probability of error, coherent system of signal reception (correlation receiver).

**Error calculations for digital modulation techniques:** Probability of error for BPSK, effect of imperfect phase synchronization and imperfect bit synchronization on probability of error in AWGN channel, probability of error calculations for QPSK, QASK and FSK schemes, use of signal space for calculation of error probability, relationship between bit error rate (BER) and symbol error rate (SER).

	RECOMMENDED BO	OOKS
Title	Author	Publisher
1. Principles of	Goutam Saha, Herbert	Tata McGraw Hill Education Private
Communication Systems	Taub, Donald Schilling	Limited, 3rd Edition, 2008
2. Communication Systems	Simon Haykin, Michael	John Wiley & Sons Publication, 5th
	Moher	Edition, 2009
3. Digital Communications	Bernard Sklar	Pearson Education Limited, 2014
4. Modern Analog and Digital	Bhagwandas Pannalal	Oxford University Press, 2010
Communication	Lathi, Zhi Ding	
5. Digital Communication	John G. Proakis, Masoud	McGraw-Hill, 2008
System	Salehi	



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CO2	3	3	2	1	2	2	2	1	0	2	0	1	3	3
CO3	3	1	1	0	2	1	1	1	0	3	2	2	3	3
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					·	Unit-I					•			12 hrs
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**Introduction:** Review of vector theory, gradient, divergence and curl, coordinate system: rectangular, cylindrical, spherical and their transformations.

**Static electric field**: Force between point charges, Coulomb's law, electric field intensity, superposition of electric fields, electric scalar potential, charge density, gradient of potential, electric flux, electric flux density or displacement density, Gauss's law, application of Gauss's law, energy in capacitor, divergence theorem, Poisson's equation and Laplace's equation, current density, continuity equation, current and field in boundary.

<u>Unit-II</u> 12 hrs

**Static magnetic field:** Magnetic induction and Faraday's law, magnetic flux density, magnetic field strength, current density in a conductor, Ampere's law, Stokes's theorem, energy stored in magnetic field, force on moving charge and current element, Biot-savart law, magnetic vector potential, boundary relation in magnetic fields.

**Time varying fields:** Maxwell equation from Faraday's law, displacement current, Maxwell 's equation from Ampere's law, equation of continuity for time varying fields, Maxwell's equations in integral and differential forms for free space, conditions at boundary surface.

Unit-III 12 hrs

Wave transmission: EM wave in a homogeneous medium, Maxwell's equations, wave equations in free space, uniform plane wave propagation, intrinsic impedance, wave equations for conducting medium, sinusoidal time variations, conductors and dielectrics, linear, elliptical and circular polarization, reflection of plane waves at interfaces, normal and oblique incidences, reflection coefficient, Brewster angle, group velocity, phase velocity, power and energy relations, Poynting vector, waves between parallel planes, TE, TM and TEM waves.

<u>Unit-IV</u> 12 hrs



**Transmission lines**: Introduction, basic principles, termination of lines with load, voltage and current distribution, characteristic impedance, propagation constant, attenuation constant, phase constant, reflection coefficient, VSWR, open and short-circuited transmission lines and their impedances, stub matching, types of high frequency transmission lines, smith charts.

	RECOMMENDED BOOKS	
Title	Author	Publisher
1. Elements of Electromagnetics	M Sadiku	Oxford University Press
2. Electromagnetics	J A Edminister	Schaum's Series
3. Electromagnetics	Kraus	McGraw Hill
4. Electromagnetic Fields and Waves	K D Parsad	Parkash Publications
5. EM waves & Radiating	Jordan, Balmain	Prentice Hall
6. Electromagnetic	W H Hayt	McGraw Hill



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CO1	2	3	3	3	2	1	0	1	2	0	2	3	3	3
CO2	3	3	3	3	2	1	0	1	1	0	0	3	3	3
CO3	2	2	3	3	1	1	0	1	1	1	2	3	3	2
CO4	3	3	3	3	3	1	0	1	0	0	0	3	3	3
				•		<u>Unit-I</u>		•	•	•	and AC	•		12 hrs

**Introduction**: Introduction, emitter coupled differential amplifier, DC and AC analysis, cascaded differential amplifier stages, level translator.

**Operational amplifiers (Op-amp):** Basic op-amp and its schematic symbol, block diagram of a typical op-amp, integrated circuits and their types, IC package types, pin identification and temperature range, overview of typical set of data sheets, characteristics and performance parameters of op-amp, equivalent circuit of an op-amp, ideal op-amp and its characteristics, ideal voltage transfer curve.

**Op-Amp parameters**: Input offset voltage, input bias current, input offset current, total output offset voltage, thermal drift, variation of op-amp parameters with supply voltage and temperature, noise, common mode configuration and common mode rejection ratio, slew rate

Unit-II 12 hrs

**Op-Amp configurations and frequency response**: Open loop configurations: differential, inverting & non-inverting. negative feedback configurations: block diagram representation of feedback configurations, voltage-series feedback amplifier, voltage shunt feedback amplifier, differential amplifiers with one op-amp, two op-amps and three op-amps. frequency response, compensating networks, frequency response of internally compensated op-amps, frequency response of non-compensated op-amps, closed loop frequency response.

<u>Unit-III</u> 12 hrs

**Applications of op-amps:** DC and AC amplifiers, peaking amplifier, summing, scaling and averaging amplifier, instrumentation amplifier, V to I and I to V converter, log and antilog amplifier, integrator and differentiator.



**Active filters:** First order and second order filter, higher order low-pass filter, second order high pass filter, band pass filter, wide band-pass filter. band reject filter, all-pass filter.

**Wave generator:** Square wave generator, triangular wave generator, saw tooth wave generator and voltage-controlled oscillator, comparator, zero crossing detector, Schmitt trigger, window detector, V to F and F to V converters, A to D and D to A converters, peak detector.

Unit-IV 12 hrs

**Specialized IC applications**: IC 555, pin configuration, block diagram, application of 555 as monostable and astable multivibrator, operating principles & applications of 565PLL.

Voltage regulators: Fixed voltage regulators, adjustable voltage regulators, switching regulators.

RECOM	MENDED BOOKS	
Title	Author	Publisher
1. Op Amps & Linear Integrated circuits	Ramakant Gayakwad	Pearson Education
2. Fundamental of Microelectronics	B Razavi	Wiley India
3. Linear Integrated Circuits	D. Roy Choudhary	New Age International
4. Design with Operational Amplifiers and Analog Integrated Circuits	Sergio Franco	Tata Mc-Graw Hill

Department of Electronics & Communication



**CO4** 

					OEE	C-611	В					
				Di	gital E	Electro	nics					
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<u>Course</u> The aim of this course is to introduce basic postulates of Boolean expre												ions and
Objectives analyze the design of combinational circuits, sequential circuits, digital lo												
families, semiconductor memories and programmable logic devices.											Č	
Course									combin			S.
Outcomes				_		al digit	_	-				
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CO1 3 3	3	1	2	2	0	1	0	0	0	2	3	3
602 2 2	<b>—</b>	4	_	_	_	4	_			-	_	2
CO2 3 3	3	1	2	2	2	1	0	0	0	2	3	3
CO3 2 3	3	1	2	2	0	1	0	0	1	2	3	3

**Introduction:** Representation of logic, logic variables, Boolean algebra, Boolean expressions and minimization of Boolean expression using K-map (up to six variables), review of logic gates, design and implementation of adder, subtractor, multiplexer, de-multiplexer, encoder, decoder, digital comparators, code converters.

**Unit-I** 

<u>Unit-II</u> 12 hrs

**Flip-flops**: Latches, S-R flip-flop, JK flip-flop, race around condition, master slave flip-flop, D & T type flip-flop, excitation table of flip-flops, conversion of flip-flops.

Unit-III 12 hrs

**Counters & shift registers**: Design with state equations, ripple counters, design of modulo-n ripple counter, pre-settable counters, up-down counter, decade counter, design of synchronous and asynchronous counters, design of shift registers with shift-left, shift-right & parallel load facilities, universal shift registers.

Unit-IV 12 hrs

**Digital logic families**: Characteristics of digital circuits: fan in, fan-out, power dissipation, propagation delay, noise margin, transistor-transistor logic (TTL), types of TTL gates, tristate logic & its applications, emitter coupled logic (ECL), CMOS, comparison of characteristics of TTL, ECL, and CMOS, interfacing of logic families.

**Semiconductor memories**: Memory organization, ROM, PROM, EPROM, EEPROM, RAM, Static RAM, dynamic RAM cell, memory cell, reading & writing operation in RAM.

12 hrs



RI	ECOMMENDED BOOK	
Title	Author	Publisher
1. Digital Design	Morris Mano	PHI, 4 <sup>th</sup> edition
2. Digital System Principles &	R J Tocci	PHI
Applications		
3. Digital Integrated Electronics	Taub Schilling	Tata McGraw Hill Education
4. Integrated Electronics	Millman & Halkias	Tata McGraw Hill Education
5. Digital Computer Electronics	Malvino Brown	Tata McGraw Hill Education
6. Modern Digital Electronics	R P Jain	Tata McGraw Hill



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Objec	ctives	deep insight to PMMC instrument and bridges. It discusses as to how the analog data is converted to digital and vice versa. It also discusses the CRO and concept of signal												
				_		vice v	versa.	It also	discus	sses the	CRO a	and con	cept of	signal
Cour	generator and analyzer.  1. Explain various types of errors introduced in measurements.													
Outco	omes	± *±												
		3. Un	dersta	nd brid	lge the	ory, w	orking	of A/I	and I	D/A con	verters a	and thei	r applic	ations.
		4. D	escribe	e the	workin	g of (	CRO,	signal	gener	ators a	nd anal	yser's a	and app	oly for
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			Maj	pping	of Cou	rse O	utcom	es witl	h Prog	ram Ou	ıtcomes	5		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	0	1	2	2	0	1	0	0	0	2	2	1
CO2	0	3	2	1	2	2	2	1	0	0	0	2	2	1
CO3	0	3	2	1	2	2	0	1	0	0	1	2	2	1
CO4	0	3	2	1	2	2	2	1	0	0	1	2	2	3
	I	I	I	I		Unit-I		I	I		ı	1		12 hrs

Unit, dimensions and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, other unit systems, dimension and standards. measurement errors: gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter.

<u>Unit-II</u> 12 hrs

**Electronic Meters**: Digital voltmeter systems, digital multimeter, digital frequency meter system, voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter.

<u>Unit-III</u> 12 hrs

**Analog to digital converter**: Transfer characteristics, A/D conversion technique: simple potentiometer and servo method, successive approximation method ramp type, integrating and dual slope integrating method. D/A converter: transfer characteristic, D/A conversion technique, digital mode of operation, performance characteristics of D/A convertors.

Unit-IV 12 hrs

**CRO**: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency, and phase by CRO, oscilloscope probes, oscilloscope specifications and performance. **Signal generator, analyzer and recorders:** sine wave, non-sinusoidal signal and function generators, frequency synthesis techniques and digital signal generators, spectrum analyzer and distortion, concept of ECG, EMI, EMC, and EEG etc, X-Y recorders, plotters.



RECOMMENDED BOOKS											
Title	Author	Publisher									
Electronic Instrumentation and Measurements	David A. Bell	2nd Ed., PHI, New Delhi,2008									
2.Electronic Measurements and instrumentation.	Oliver and Cage	TMH, 2009									



	OEEC-612A Principle of Communication Engineering														
			]	L Prii	icipie o	1 Com		ation E		ring P			Credit	S	
				3		(	)			0			3		
		Session	nal Ma	rks									50		
		End So	emestei	r Exam	ination	Marks	S						50		
Cours	<u>e</u>	The r	nain fo	ocus of	the co	ourse i	s on	underst	anding	the i	mporta	nce ar	and theories of		
Object		comm	unicatio	on syst	tems.	Γhe st	udents	will	study	the v	arious	analo	g and	digital	
		comm	unication	on techr	niques, g	generat	ion, de	tection	, transn	nission	and re	ception	method	ds.	
Cours	1. Gain knowledge about the fundamental concepts communication systems.														
Outco	utcomes 2. Analyse AM, SSB, FM and PM transmission and reception circuits.														
3. Analyze the performance of amplitude and frequency modulated systems and design												esign of			
		P	AM, P	WM and	d PPM s	systems	S.								
			-		dge abo	out the	basic o	concept	s of di	gital m	odulati	on and	demod	lulation	
		te	echniqu												
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	2	2	2	2	0	1	0	2	1	2	3	3	
CO2	3	3	3	3	2	2	1	1	2	2	1	2	3	3	
CO3	1	1	1	0	1	2	0	1	1	1	3	2	3	3	
CO4	2	1	1	2	0	2	0	1	1	0	1	2	3	3	
					Ţ	J <u>nit-I</u>								12 hrs	

**Introduction:** Communication, information, message and signals, electromagnetic spectrum, classification of signals, periodic and non-periodic signals, analog and digital signals, deterministic and random signals, elements of a communication system, modulation and its types, need for modulation.

**Amplitude modulation:** Definition, expression of AM wave, modulation index, frequency spectrum, bandwidth, power contents of sidebands and carrier.

Unit-II 12 hrs

**Angle modulation:** Concepts of angle modulation, theory of frequency modulation, mathematical analysis of FM, spectra of FM signals, narrow band FM, wide band FM, phase modulation, phase modulation obtained from frequency modulation, comparison of AM, FM and PM.

Generation of AM and FM waves: Basic principle of AM generation, basic principle of FM generation, varactor diode modulator. DSB-SC, SSB, their comparison and areas of applications.

Unit-III 12 hrs

**Pulse modulation:** Sampling process, sampling theorem, natural sampling, flat top sampling rate, aliasing, basic idea about PAM, PWM and PPM and typical applications, reconstruction of message, pulse code modulation (PCM), block diagram of PCM system, quantization.

Department of Electronics & Communication



Unit-IV 12 hrs

**Elements of digital communication:** Block diagram of digital communication system, digital representation of analog signals, advantages and disadvantages of digital communication system,

**Digital carrier modulation techniques**: Introduction, amplitude shift keying (ASK), ASK spectrum, ASK modulator, frequency shift keying (FSK), PSK.

**Digital carrier demodulation techniques:** Coherent ASK detector, non-coherent ASK detector, non-coherent FSK detector, coherent FSK detector.

RECOMMENDED BOOKS										
Title	Author	Publisher								
1. Communication Systems (Analog and	Sanjay Sharma	S.K. Kataria & Sons								
Digital)										
2. Electronic Communication Systems	Kennedy	Tata McGraw Hill								
3. Electronic Communications	Roddy and Coolen	Prentice Hall of India								
4. Principles of Communication Systems	Taub and Schilling	Tata McGraw Hill								



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						Opt	ical El	ectron	ics						
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				3			0			0			3		
		Sess	sional	Marks									50	50	
		End	l Seme	ster E	xamina	ation N	<b>Aarks</b>						50		
Cours	<u>e</u>	The	main	object	ive of	this c	ourse i	is to fa	amiliar	ize wit	h the	basics of	of semiconductor		
Objec	tives	opto	electro	onics a	and va	rious	optical	devic	es i.e	. optica	al sour	ces, m	odulators	s, photo	
	detectors, display devices. Students will also study the modern optoelectronics integrate													_	
	systems.														
	· ·														
Cours					of phy	sics to	analyz	e the fu	ındame	ental co	ncepts	of vario	us optoel	lectronic	
Outco	mes		ompon												
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CO1	2	2	3	3	2	1	2	1	0	0	2	2	2	3	
CO2	3	3	3	3	2	2	0	1	2	1	0	1	2	3	
CO3	3	3	2	2	3	2	1	1	2	0	3	3	2	2	
CO4	3	3 3 3 2 2 2 1 2 0 3 3 2 2													
	<u>Unit-I</u>										8 hrs				

**Elements of light and solid-state physics**: Wave nature of light, polarization, interference, diffraction, light source, review of quantum mechanical concept, review of solid-state physics, generic optical systems and fundamental building blocks, basics of semiconductor optoelectronics, elemental and compound semiconductor, electronic properties and optical processes in semiconductors.

<u>Unit-II</u> 14 hrs

**Optical sources and modulator**: Emission and absorption of radiation, absorption of radiation, population inversion, optical feedback, threshold conditions-laser losses, line shape function, population inversion and pumping threshold conditions, laser modes, classes of laser, single mode operation, frequency stabilization, VCSEL, mode locking, Q switching, laser applications, high power applications of lasers, LEDs electrooptic effect, electro-optic switch and modulator, Kerr modulators, MZM modulators, electro-absorption modulator..

Unit-III 14 hrs

**Photo detectors**: Principle of optical detection, detector performance parameters, thermal detectors, photon devices, solar cell.

**Display devices**: Luminescence, photoluminescence, cathode luminescence, cathode ray tube, electro luminescence, injection luminescence and light emitting diodes, plasma displays, display brightness, LCD, numeric displays.



<u>Unit-IV</u> 12 hr											
Optoelectronic integrated circuits: Introduction, hybrid and monolithic integration, application of											
optoelectronic integrated circuits, integrated transmitters and receivers, guided wave devices.											
RECOMMENDED BOOKs											
Title	Author	Publishe	r								
1. Semiconductor Optoelectronic Devices	Pallab Bhattacharya	Pearson Educatio	n Inc								
2. Photonics - Optical Electronics in Modern Communications	A. Yariv and P. Yeh,	Oxford University	y Press								
3. Opto Electronics – As Introduction to materials and devices	Jasprit Singh	McGraw-Hill International									
4. Opto Electronics – An Introduction	J. Wilson and J. Haukes	Prentice Hall, 199	95								



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		Ses	ssional	Mark	s								50		
		En	d Sem	ester E	Cxamin	ation I	Marks					50			
Cours Objec		lan		for n										mming g and	
Course Outcomes  1. Understand basic commands, manage contents and develop programs in MATLAB. 2. Perform mathematical modeling in MATLAB. 3. Evaluate, analyze and plot results. 4. Utilize programming skills to enhance learning and performance in engineering.															
		ı			Course						ı	1	I		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1		
CO1	3	3	3	2	3	1	1	1	2	1	2	3	2	2	
CO2	2	3	3	3	3	2	1	1	2	1	1	2	2	3	
CO3	3	3	3 3 3 0 0 1 3 2 2 3 1 2							2					
CO4	3	2	2	3	3	1	0	1	3	2	2	3	3	2	
	-	•	•	-		Unit-I	•	-	-	•	-		-	12 hrs	
Intera	ctive c	ombiii	ation:	Basics	of MA	TLAB	. MAT	TAB v	window	s innii	t-outpi	ıt file	types g	eneral	

**Interactive computation:** Basics of MATLAB, MATLAB windows, input-output, file types, general commands, working with arrays of numbers, creating and plotting simple plots, creating, saving and executing script and function files, language specific features, and advanced data objects.

Unit-II 12 hrs

**Matrices and vectors manipulation:** Matrices and vectors input, indexing, matrix manipulation, creating vectors, matrix and array operations, arithmetic operations, relational operations, logical operations, elementary math functions, matrix functions and character strings.

Unit-III 12 hrs

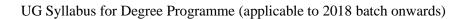
**Linear algebra, interpolation and data analysis:** Solving a linear system, Gaussian elimination, finding eigen values & eigenvectors, matrix factorization, polynomial curve fitting, least squares curve fitting, interpolation, data analysis and statistics, MATLAB applications in linear algebra, curve fitting and interpolation, data analysis and statistics.

Unit-IV 12 hrs

**Graphics manipulation:** Basic 2-D plots, style options, labels, title, legend, and other text objects, axis control, zoom-in and zoom-out, modifying plots, overlay plots, specialized 2-D plots and introduction to 3-D plots.

RECOMMENDED BOOKS										
Title	Author	Publisher								
1. Getting Started with MATLAB	Rudra Pratap,	Oxford University Press								
2. MATLAB Programming	Y. Kirani Singh,	PHI								
	B. B. Chaudhuri									
3. MATLAB and Its Applications	Raj Kumar Bansal	Pearson Education India								
in Engineering										

Department of Electronics & Communication





4. MATLAB by Example Abhishek Kr Gupta, Finch Publications

Department of Electronics & Communication



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Cours	s <u>e</u>	The	course	e descri	bes vai	rious li	near wa	ave sha	ping ci	rcuits,	switchi	ng chai	acteris	tics of
Objec	tives									uits. T		_		
	circuits, Schmitt trigger circuit using transistors, blocking oscillator circuits and the													
			ign ope				_			_				
Cours														
	Outcomes and transistors.													
		2. A	nalyze	differe	nt type	s of mu	ıltivibr	ator an	d their	design	proced	ures.		
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			esign li		_				_					
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CO2	3	3	3	3	2	2	0	1	0	2	1	1	3	2
CO3	2	1	1	2	1	0	0	1	2	1	0	0	2	3
CO4	3	3	3	3	3	2	1	1	0	2	1	1	2	3
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**Linear wave shaping**: High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square, ramp and exponential inputs, high pass RC circuit as differentiator and low pass RC circuit as integrator, attenuators, RL and RLC circuits and their response for step input, ringing circuit.

**Non-linear wave shaping**: Diode clippers, transistor clippers, clipping at two independent levels, emitter coupled clipper, diode comparators, applications of voltage comparators, clamping operation, clamping circuits using diode with different inputs, clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage.

Unit-II 12 Hrs

**Switching characteristics of devices**: Diode as a switch, diode switching times, temperature variation of saturation parameters, design of transistor as a switch, transistor switching times, transistor in saturation.

**Bistable multivibrators**: Stable states of a bistable multivibrator, design and analysis of fixed bias and self-biased bistable multivibrator, direct connected binary circuit, Schmitt trigger circuit using transistors, emitter coupled bistable multivibrator.

Unit-III 12 Hrs

**Monostable and astable multivibrators**: Monostable multivibrator, design and analysis of collector coupled, and emitter coupled monostable multivibrator, triggering of monostable multivibrator, astable multivibrator, collector coupled and emitter coupled astable multivibrator.



Unit-IV 12 Hrs

**Time base generators**: General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators – basic principles, transistor Miller time base generator, transistor Bootstrap time base generator, current time base generators, methods of linearity improvements.

**Blocking oscillator circuits**: Triggered transistor blocking oscillator, an astable transistor blocking oscillator, applications of blocking oscillators.

RECOMMENDED BOOKS										
Title	Author	Publisher								
1. Pulse, Digital and Switching Waveforms 3rd Edition, 2008.	Millman and Taub	Tata McGraw-Hill								
2.Microelectronic Circuits, 7th Edition 2014	Sedra and Smith	Oxford University Press								
3. Pulse and Digital Circuits, 2006	Motheki S. Prakash Rao	Tata McGraw-Hill								
4. Fundamental of Microelectronics, 2nd Edition 2009	B.Razavi	John-Wiley								



							CEC-61 MEMS							
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		Sessi	onal M	arks									50	
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Course	<u>e</u>	The o	course	aims to	give	the stu	dents a	basic	knowle	edge al	out sta	ate-of-t	he-art	MEMS
<b>Object</b>	<u>tives</u>	including technology, device architecture, design and modelling, scalability, figures of												
		merit and RF IC novel functionality and performance. Reliability and packaging are also considered as key issues for industrial applications.												
Cours	Course 1. To gain basic knowledge about MEMS and its various micro system products.													
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		4. To	attain l	knowle	dge abo	out vari	ous lev	els of	oackagi	ing of n	nicrosy	stems.		
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CO1	3	3	2	3	2	2	2	1	3	2	1	2	2	1
CO2	2	2	2	2	1	0	1	1	3	2	1	2	2	2
соз	3	3	1	1	0	0	3	1	3	2	1	2	1	1
CO4	2	2	1	2	1	0	1	1	3	2	1	2	2	2
						Unit-I	I	I	I	1	1		1	12 hrs

**MEMS and microsystems**: MEMS and micro system products, evaluation of micro fabrication, Microsystems and microelectronics, applications of microsystems, working principles of Microsystems, micro actuators, micro actuators, MEMS and micro actuators, micro accelerometers.

**Scaling laws in miniaturization:** Introduction, scaling in geometry, scaling in rigid body dynamics, the trimmer force scaling vector, scaling in electrostatic forces, electromagnetic forces, scaling in electricity and fluidic dynamics, scaling in heat conducting and heat convection.

Unit-II 12 hrs

**Materials for MEMS and microsystems**: Substrates and wafers, silicon as a substrate material, ideal substrates for MEMS, single crystal Silicon and wafers crystal structure, mechanical properties of Si, Silicon compounds; SiO<sub>2</sub>, SiC, Si<sub>3</sub>N<sub>4</sub> and polycrystalline silicon, silicon piezo-resistors, gallium arsenide, quartz, piezoelectric crystals, polymers for MEMS, conductive polymers.

Engineering mechanics for microsystems design: Introduction, static bending of thin plates, circular plates with edge fixed, rectangular plate with all edges fixed and square plates with all edges fixed. Mechanical vibration, resonant vibration, micro accelerometers, design theory and damping coefficients. thermo mechanics, thermal stresses. fracture mechanics, stress intensity factors, fracture toughness and interfacial fracture mechanics.



Unit-III 12 hrs

**Basics of fluid mechanics in macro and mesco scales**: Viscosity of fluids, flow patterns Reynolds number. basic equation in continuum fluid dynamics, laminar fluid flow in circular conduits, computational fluid dynamics, incompressible fluid flow in micro conducts, surface tension, capillary effect and micro pumping, fluid flow in sub micrometer and nanoscale, rarefied gas, Knudsen and Mach number and modeling of micro gas flow, heat conduction in multilayered thin films, heat conduction in solids in sub micrometer scale, thermal conductivity of thin films - heat conduction equation for thin films.

<u>Unit-IV</u> 12 hrs

**Micro system packaging and applications of MEMS**: Micro system packaging, general considerations, the three levels of microsystems packaging, die level, device level and system level, essential packaging technologies, die preparation, surface bonding wire bonding and sealing, three-dimensional packaging, assembly of microsystems, selection of packaging materials.

The MEMS switch and its design consideration: The MEM resonator and its design considerations, micromachining-enhanced planar microwave passive elements.

RECON	MENDED BOOKS	
Title	Author	Publisher
MEMS and Microsystems Design and Manufacture	Tai-Ran Hsu	Tata McGraw Hill
2. Fundamentals of Micro fabrication	Mark Madou	CRC Press
3. Micro sensors: Principles and Applications	J. W. Gardner	John Willey ,2009
4. Semiconductor Sensors	S. M. Sze	Tata McGraw Hill
5. An Introduction to Microelectromechanical Systems Engineering	Nadim Maluf and Kirt Williams	Artech, 2 <sup>nd</sup> Edition, 2004
6. Introduction to Microelectromechanical Microwave Systems	Hector J. De Los Santos	Artech, 2 <sup>nd</sup> Edition, 2004



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		E	nd Sen	nester	Exami	nation	Marks					50			
Cour Obje	<u>rse</u> ectives	the enter too disconnection con content to c	The aims of this course are to introduce the principles and applications of information theory. The course will study how information is measured in terms of probability and entropy, and the relationships among conditional and joint entropies; how these are used to calculate the capacity of a communication channel, with and without noise; how discrete channels and measures of information generalize to their continuous forms; complexity, compression, and efficient coding of text, and audio-visual information coding schemes; including error detecting and correcting codes, block coding, convolutional coding, Viterbi decoding algorithm, Trellis coded modulation and information security: cryptographic coding.												
Cour	rse	1.	Learn t	the con	cept of	Inform	ation a	nd to ca	alculate	e the inf	ormatio	n conte	nt of a r	andom	
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	Mapping of Course Outcomes with program outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO	3	2	0	0	2	2	0	1	1	0	1	2	2	2
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CO	0	3	0	3	0	2	0	1	0	0	2	2	3	3
4														
CO	3	0	2	0	0	3	3	1	2	0	2	2	3	3
5														
					T	Init_I								12 hrs

**Information theory**: Concept of amount of information -units, entropy -marginal, conditional and joint entropies -relation among entropies, mutual information, information rate, channel capacity, redundancy and efficiency of channels.

**Discrete channels**: Symmetric channels, binary symmetric channel, binary erasure channel, cascaded channels, repetition of symbols, binary symmetric channel, Shannon theorem, continuous channels – capacity of band limited Gaussian channels, Shannon-Hartley theorem, trade-off between band width and signal to noise ratio, capacity of a channel with infinite band width, optimum modulation system.

Unit-II 12 hrs

**Source coding**: Encoding techniques, purpose of encoding, instantaneous codes, construction of instantaneous codes, Kraft's inequality, coding efficiency and redundancy, noiseless coding theorem,



construction of basic source codes – Shannon-Fano algorithm, Huffman coding, arithmetic coding, ZIP coding.

**Source coding, text, audio and speech**: Text: Adaptive Huffman coding, arithmetic coding, LZW algorithm audio: perceptual coding, masking techniques, psychoacoustic model, MEG audio layers I, II, Dolby AC3 speech: channel vocoder, linear predictive coding.

**Source coding, image and video**: Image and video formats – GIF, TIFF, SIF, CIF, QCIF, image compression: READ, JPEG, video compression: principles-I, B, P frames, motion estimation, motion compensation, H.261, MPEG standard.

<u>Unit-III</u> 12 hrs

Codes for error detection and correction: Parity check coding, linear block codes, error detecting and correcting capabilities, generator and parity check matrices, standard array and syndrome decoding.

**Block codes**: Definitions and principles: Hamming weight, Hamming distance, minimum distance decoding - single parity codes, hamming codes, repetition codes - linear block codes, cyclic codes - syndrome calculation, encoder and decoder – CRC.

Unit-IV 12 hrs.

**Convolution codes:** Code tree, trellis, state diagram, structural properties, encoding – decoding: sequential search and Viterbi algorithm – principle of turbo coding, soft-decision decoding, and Viterbi decoding algorithm.

Advanced coding techniques and cryptography: BCH codes, trellis coded modulation, introduction to cryptography, overview of encryption techniques, symmetric cryptography, DES, IDEA, asymmetric algorithms, RSA algorithm.

RECOM	RECOMMENDED BOOKS												
Title	Author	Publisher											
1. Information Theory, Coding and Cryptography,	Ranjan Bose	Tata McGraw Hill											
2. Applied Coding and Information Theory for Engineers	Richard B. Wells	Pearson											
3. Coding and Information Theory,	.R. W. Hamming	Prentice Hall, 2 <sup>nd</sup> edition,											
4. Information Theory and Reliable Communication,	R. G. Gallager,	Wiley											
5. The Theory of Information and Coding.	R.J. McEliece	Addison –Wesley											
6. Introduction to information Theory	M. Mansuripur,	Prentice Hall											
7. Principles of communication	Taub & Schilling	McGraw Hill											
8. Elements of Information Theory	Thomas Cover & Joy Thomas	John Wiley & Sons											



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Cours	<u>se</u>	This	lab inc	ludes h	ardwar	e kits	as well	softwa	are sim	ulator 1	to analy	yze dif	ferent a	analog			
<b>Objec</b>	<u>tives</u>	comn	nunicati	on syst	tems. T	he mai	in objec	ctive is	to ana	lyze the	e perfo	rmance	of AM	1, FM			
		modu	lation	systems	in tim	e and	frequen	cy don	nain, to	study	and de	sign th	e circu	its for			
		transr	ansmission and reception of AM, FM and pulse modulation systems.  Design and analyze AM and FM modulation circuits on hardware as well as on														
Cours	<u>se</u>	1. Des	sign and	d analyz	ze AM	and FM	I modul	lation c	ircuits o	on hard	ware as	well as	on				
Outco	mes	MU	JLTISI	M simu	lator.												
		2. Un	2. Understand transmission and reception of AM and FM systems.														
		3. Design and analyze various pulse modulation systems on hardware as well as on															
		MU	JLTISII	M simu	lator.												
		4.Τo ι	ındersta	and vari	ious tra	nsmissi	ion and	recepti	on metl	hods an	d their	compar	ison.				
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# **List of Experiments (Hardware):**

### **PART-A**

- 1. To measure the modulation index of AM signal using the sine wave method and trapezoidal
- 2. method.
- 3. To setup the circuit of AM modulator using transistor.
- 4. To setup the circuit of envelop detector for AM demodulation.
- 5. To study the DSB/SC AM signal and its demodulation using product detector circuit.
- 6. To study the generation and detection of FM signals.
- 7. To study the AM transmitter circuit and observe the waveforms at test points.
- 8. To study the FM transmitter circuit and observe the waveforms at test points.
- 9. To study the AM receiver circuit and observe the waveforms at test points.
- 10. To study the sampling process and time division multiplexing.
- 11. To study the pulse amplitude modulation and demodulation circuits.
- 12. To study the pulse width modulation and demodulation circuits.
- 13. To study the pulse code modulation and demodulation circuits.

## **Software (using MULTISIM)**

- 1. To study the spectrum of pulses using spectrum analyzer.
- 2. To measure the modulation index of AM signal using the sine wave method and trapezoidal method.
- 3. To observe the amplitude spectrum and measure the bandwidth of AM signal.
- 4. To setup the circuit of AM modulator using transistor.
- 5. To setup the circuit of envelop detector for AM demodulation.
- 6. To setup the circuit of DSB/SC AM and DSB-FC AM using product modulator/multiplier.



- 7. To study the FM wave generated from FM source in MULTISIM and measure the modulation index by approximate method.
- 8. To observe the amplitude spectrum and measure the bandwidth of FM signal.
- 9. To generate FM signal using voltage-controlled oscillator on MULTISIM and observe the waveforms on CRO.
- 10. To generate pulse amplitude modulation (PAM) signal and observe its waveform.
- 11. To generate PWM signal using 555 timer IC and observe its waveform.
- 12. To generate PPM signal and observe its waveform.

#### **PART-B**

#### Hardware

- 1. To study time division multiplexing system.
- 2. to study pulse code modulation and demodulation.
- 3. To study delta modulation and demodulation and observe effect of slope overload.
- 4. To study pulse data coding techniques for various formats.
- 5. To study amplitude shift keying modulator and demodulator.
- 6. To study frequency shift keying modulator and demodulator.
- 7. To study phase shift keying modulator and demodulator.

#### Software

- 1. To generate BASK signal and observe the frequency spectrum on MULTISIM software.
- 2. To generate BPSK signal and observe the frequency spectrum on MULTISIM software.
- 3. To generate BFSK signal and observe the frequency spectrum on MULTISIM software.
- 4. To setup the model for BPSK baseband modulation for scatter plot to observe the constellation on MATLAB/SIMULINK software.
- 5. To setup the model for QPSK baseband modulation for scatter plot on to observe the constellation on MATLAB/SIMULINK software.
- 6. To setup the model for BFSK baseband modulation for scatter plot on to observe the constellation on MATLAB/SIMULINK software.
- 7. To setup the BPSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.
- 8. To setup the QPSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.
- 9. To setup the BFSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.



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CO2	3	3	3	3	2	1	1	1	1	0	0	3	3	3
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CO4	3	3	3	3	3	1	1	1	0	0	0	3	3	3
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**Introduction**: Introduction, emitter coupled differential amplifier, DC and AC analysis, cascaded differential amplifier stages, level translator.

**Operational amplifiers (Op-amp):** Basic op-amp and its schematic symbol, block diagram of a typical op-amp, integrated circuits and their types, IC package types, pin identification and temperature range, overview of typical set of data sheets, characteristics and performance parameters of op-amp, equivalent circuit of an op-amp, ideal op-amp and its characteristics, ideal voltage transfer curve.

**Op-Amp parameters**: Input offset voltage, input bias current, input offset current, total output offset voltage, thermal drift, variation of op-amp parameters with supply voltage and temperature, noise, common mode configuration and common mode rejection ratio, slew rate

Unit-II 12 hrs

**Op-Amp configurations and frequency response**: Open loop configurations: differential, inverting & non-inverting. negative feedback configurations: block diagram representation of feedback configurations, voltage-series feedback amplifier, voltage shunt feedback amplifier, differential amplifiers with one op-amp, two op-amps and three op-amps. frequency response, compensating networks, frequency response of internally compensated op-amps, frequency response of non-compensated op-amps, closed loop frequency response.

<u>Unit-III</u> 12 hrs

**Applications of op-amps:** DC and AC amplifiers, peaking amplifier, summing, scaling and averaging amplifier, instrumentation amplifier, V to I and I to V converter, log and antilog amplifier, integrator and differentiator.

Department of Electronics & Communication



**Active filters:** First order and second order filter, higher order low-pass filter, second order high pass filter, band pass filter, wide band-pass filter. band reject filter, all-pass filter.

**Wave generator:** Square wave generator, triangular wave generator, saw tooth wave generator and voltage-controlled oscillator, comparator, zero crossing detector, Schmitt trigger, window detector, V to F and F to V converters, A to D and D to A converters, peak detector.

<u>Unit-IV</u> 12 hrs

**Specialized IC applications**: IC 555, pin configuration, block diagram, application of 555 as monostable and astable multivibrator, operating principles & applications of 565PLL.

**Voltage regulators:** Fixed voltage regulators, adjustable voltage regulators, switching regulators.

RECOMMENDED BOOKS											
Title	Author	Publisher									
1.Op Amps & Linear Integrated circuits	Ramakant Gayakwad	Pearson Education									
2. Fundamental of Microelectronics	B Razavi	Wiley India									
3. Linear Integrated Circuits	D. Roy Choudhary	New Age International									
4. Design with Operational Amplifiers and Analog Integrated Circuits	Sergio Franco	Tata Mc-Graw Hill									



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		C	concep	ts of C	CDMA	and C	GSM v	vireles	s com	municat	tion star	ndards.		
Course O	utcon	<u>1es</u> 1	<ol> <li>Understand the concept of cellular system.</li> <li>Distinguish between different types of fading in wireless communication.</li> </ol>											
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Introduction to wireless communication systems: Concept of cellular communication system, basics of wireless cellular system, mobile unit, base station, mobile switching centre, frequency reuse, channel assignment strategies, co-channel interference, determining the frequency reuse distance, hand-off strategies, interference and system capacity, trunking efficiency, improving capacity of cellular system, cell splitting and sectoring.

> **Unit-II** 12 hrs

Mobile radio propagation: Introduction to radio wave propagation, free space propagation model, basic propagation mechanisms, reflection, diffraction, scattering, outdoor propagation models, indoor propagation models, signal penetration into buildings, types of small-scale fading, fading effects due to Doppler spread and delay spread, diversity techniques.

> **Unit-III** 12 hrs

Modulation techniques: Introduction to linear modulation techniques, minimum shift keying, Gaussian minimum shift keying, spread spectrum modulation techniques, DS-SS, and FH-SS systems, performance of modulation schemes, power spectrum and error performance in fading channels.

Unit-IV

Wireless communication standards: Introduction to GSM, GSM services and features, system architecture, radio subsystem and channel types. cellular code division multiple access (CDMA) systems: principle, power control, effects of multipath propagation on code division multiple access and introduction to third generation wireless networks, long term evolution (LTE) and standards, introduction to 5G technology.

Dilip Kumar

Department of Electronics & Communication



RECOMMENDED BOOKS												
Title	Author	Publisher										
1.Wireless Communications	T.S Rappaport	Pearson Education, 2003.										
2.Principles of Mobile Communication	Gordon L. Stuber	Springer International Ltd., 2001.										
3. Wireless Communications	Andrea Goldsmith	Cambridge University Press, 2007										



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<ol> <li>Course</li> <li>Acquire the knowledge of hardware features, architecture of 8085.</li> <li>Write basic assembly language program in 8085.</li> </ol>													
3. Understand design of memory systems and develop programs for											for cor	nmunica	tions and
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			l	Ţ	Jnit-I			Î					12hrs

**Introduction:** Digital computing, computer languages, from large chip computers to single chip microcomputers, microcomputers organization, and 4-bit microprocessors.

**8-bit microprocessor architecture**: Microprocessor architecture & its operations, memory, input/output, interfacing devices MPU, 8085 based microcomputer, instruction classification, instruction format, instruction timings, 8080 a MPU, overview of 8085/8080a instruction set.

Unit-II 12 hrs

**Programming using 8085 microprocessors**: Data transfer instructions, arithmetic operations, logic operations, branch operations, programming techniques using looping counting & indexing, dynamic debugging, time delays, counters, stack, subroutines, conditional call, and return instructions, advanced subroutine concepts.

Unit-III 12 hrs

**Interrupts**: The 8080A interrupts the 8085 interrupts, restart instructions, additional I/O concepts & processes.

**Parallel input/output and interfacing applications**: Basic interfacing concepts, interfacing output displays, interfacing input keyboards, and memory mapped I/O, interfacing memory, interfacing D/A& A/D converters.

Unit-IV 12 hrs

**General purpose programmable peripheral devices**: Introduction to 8155/8156,8255 a programmable peripheral interface, 8253 programmable interval timers, 8259 a programmable interrupt controller, SID & SOD lines, 8251 USART.

**Microprocessor applications:** Temperature controller, traffic light controller, stepper motor control, comparison of 8-bit, 16-bit and 32-bit microprocessors, introduction to Pentium processors.

Department of Electronics & Communication



RECON	MMENDED BOOKS	
Title	Author	Publisher
1.Microprocessor Architecture- Programming & Applications with 8085/8080A	Ramesh S Gaonkar	5 <sup>th</sup> Edition, Penram International Publishing
2.Introduction of Microprocessors & Microcomputers	Ram B	4 <sup>th</sup> Edition, Dhanpat Rai Publisher (P) Ltd.
3.Microprocessor Interfacing Technique	Rodnay Zaks and Austin Lesea	1 <sup>st</sup> Indian Edition, BPB Publication
4.An introduction to Intel family of Microprocessors	James L Antonakes	3 <sup>rd</sup> Edition, Pearson Education
5.Microprocessor Principles and Applications	Charles M Gilmore	2 <sup>nd</sup> Edition, McGraw Hill



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**Process integration**: Process integration for NMOS, CMOS and bipolar circuits. **Advance MOS technology**: Introduction and latest trends in VLSI technology.



RECOMMENDED BOOKS													
Title	Author	Publisher											
1. The Science and Engineering of	Stephen A.	Oxford University Press, 2012											
Microelectronic Fabrication	Campbell												
2. VLSI Technology 2 <sup>nd</sup> edition	Sze	McGraw-Hill Book Company, New Delhi, 1988											
3. VLSI Fabrication Principles	Sorab K. Gandhi	John Wiley, 1994											



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CO2	2	2	2	2	1	2	1	1	3	0	1	2	1	3				
CO3	2	2	2	1	2	3	3	1	2	0	1	2	2	3				
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chemical methods, reverse micelles, electro-deposition, pyrolytic synthesis, self-assembly strategies.

Semiconductor nano particles- size-dependent physical properties: Melting point, solid-state phase transformations, excitons, band-gap variations-quantum confinement.

> 12 hrs **Unit-III**

Semiconductor nano particles-applications: Optical luminescence and fluorescence from direct band gap semiconductor nanoparticles, surface-trap passivation in core-shell nanoparticles, carrier injection.

**Doping:** Electroluminescence, barriers to nanoparticle lasers, doping nanoparticles, Mn-Zn-Se phosphors, light emission from indirect semiconductors, light emission form Si Nanodots.

Unit-IV

Semiconductor nanowires: Fabrication strategies, quantum conductance effects in semiconductor nanowires, porous silicon, nanobelts, nanoribbons, nano springs.

**Physical methods:** Inert gas condensation, arc discharge, RF-plasma, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis



RECOMM	RECOMMENDED BOOKS											
Title	Author	Publisher										
1. Encyclopedia of Nanotechnology	Hari Singh Nalwa	Springer Inc.										
2. Springer Handbook of Nanotechnology	Bharat Bhusan	Springer Inc.										
3. Introduction to Nanotechnology	Poole Jr., C.P., Owens, F.J	Wiley Inc.										
4. A Textbook of Nanoscience and Nanotechnology	B S Murthy	Springer Inc.										



L T P   Sessional Marks   End Semester Examination Marks   To familiarize constructional and functional details of man-instrument synderlying principle of electro-physiological signal measurement constructional and functional details of the different biomedical equipment understanding signal processing techniques for extracting information of parameters.    Course Outcomes   1. Understand linkages between the life sciences and engineering techniques for extracting information of parameters.   2. Familiarize with constructional and functional details of man-instructional including underlying principle of electro-physiological signal meanalysis.   3. Conceptualize underlying technology with regard to constructional details of biomedical equipment.	Cred	its									
Sessional Marks   End Semester Examination Marks		its									
Sessional Marks  End Semester Examination Marks  To familiarize constructional and functional details of man-instrument sy underlying principle of electro-physiological signal measurement constructional and functional details of the different biomedical equipment understanding signal processing techniques for extracting information of parameters.  Course  1. Understand linkages between the life sciences and engineering tech fair understanding about anatomy and physiology of human body.  2. Familiarize with constructional and functional details of man-instructional underlying principle of electro-physiological signal measurement constructional and functional details of man-instructional underlying principle of electro-physiological signal measurement constructional and functional details of man-instructional underlying principle of electro-physiological signal measurement constructional and functional details of man-instructional underlying principle of electro-physiological signal measurement constructional and functional details of man-instructional underlying underlying technology with regard to constructional analysis.  3. Conceptualize underlying technology with regard to constructional		100									
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<u>Unit-I</u>		10 hrs									

**Biomedical instrumentation**: Man-instrument system, physiological systems of human, transducers for biomedical applications, sources of bioelectric potentials, resting and action potentials, propagation of action potentials, bioelectric potential, electrode theory, bioelectric potential electrodes, biochemical transducers,

<u>Unit-II</u> 14 hrs

**Biomedical recording systems:** Basic recording system, general considerations for signal conditioners, preamplifiers, biomedical signal analysis techniques, signal processing techniques, amplifier and driver stage, writing systems, inkjet recorders, potentiometric recorders, digital recorders, electrocardiograph, vector cardiograph, phonocardiograph, electroencephalograph, electromyography, oximeters, blood flow meters, spirometry and pulmonary function measurements.

<u>Unit-III</u> 12 hrs

**Modern imaging systems:** Basics of diagnostic radiology, digital radiography, constructional and operational details of X-ray machine, X-ray computed tomography, nuclear medical imaging system, magnetic resonance imaging system, ultrasonic imaging system and thermal imaging system.



<u>Unit-IV</u> 12 hrs

**Biotelemetry**: Physiological parameters adaptable to biotelemetry, components of biotelemetry system, implantable units, applications in patient care and monitoring, wireless telemetry, single channel telemetry system, multi-channel wireless telemetry system, multi-patient telemetry, implantable telemetry system, analog physiological signal transmission over telephone lines and telemedicine.

RECOMMENDED BOOKS												
Title	Author	Publisher										
1. Biomedical Instrumentation	Leslie Cromwell, Fred J. Weibell	Pearson Prentice Hall2006										
and Measurements	and Erich A. Pfeiffer											
2. Introduction to Biomedical	Joseph J. Carr and John M.	Pearson Education India, 2001										
Equipment Technology	Brown											
3. Handbook of Biomedical	R. S. Khandpur	Tata-McGraw Hill Education,										
Instrumentation		2003										



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CO2	3	1	1	1	0	0	0	1	1	0	0	1	3	2
CO3	3	3	2	2	0	0	0	1	0	0	0	1	3	2
CO4	3	3	3	1	0	1	1	1	0	0	2	2	3	2
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Intro	duction	n: Intro	duction	to cor	ntrol sv	stems.	servom	echani	sm. op	en loon	contro	ol syste	m. clos	ed loop

**Introduction**: Introduction to control systems, servomechanism, open loop control system, closed loop control system with block diagrams and illustrative examples, AC and DC servomotors, stepper motor, concept of transfer function, characteristic equations, physical system modeling, formulation of equations for linear electrical, mechanical, thermal, hydraulic and pneumatic systems, electrical- mechanical analogies. signal flow graphs, block diagram simplification for linear systems.

Unit-II 12 hrs

**System response:** Time domain and frequency domain response of the first and second order systems. time domain specifications, steady state error and coefficients, type and order of system with P, PI, PD and PID controller, relation between time and frequency response for second order systems.

Unit-III 14 hrs

**Stability analysis**: Pole-zero location and stability, Routh-Hurwitz criterion, root locus, log. magnitude versus phase angle plot, bode plots, Nyquist criterion for stability, necessity of compensation, lead, lag and lead-lag compensation networks.



<u>Unit-IV</u> 10 hrs

**State variable analysis**: State space representation of continuous time systems, state equations, transfer function from state variable representation, solution of state equations, controllability and observability, state space representation of discrete time systems.

RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Modern Control Engineering	Ogata K	Prentice Hall, 5th Edition 2010									
2. Automatic Control Systems	Kuo BC	Prentice Hall, 9th Edition 2014									
3. Modern Control Systems Engineering,	Nagrath I J and Gopal M	New age international, 3rd Edition, 2014.									
4. Linear Control System	B S Manke	Khanna Publishers, 12th edition									



CO<sub>2</sub>

**CO3** 

**CO4** 

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	components will be explained. Problems in the transistor amplifier and how to use op amp to solve these problems will be explained. This is necessary and essential in															
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		3	Addres	s desig	n challe	enges fo	or amp	lifiers u	ising tra	ansistoi	and of	o-amps	•			
		4.	Analyz	e and d	lesign d	lifferen	t base c	lrive ci	rcuits.							
			Maj	pping o	of Cour	se Out	tcomes	with p	rogran	n outco	mes					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO1	2	2	2	2	0	0	0	1	0	0	1	1	1	3		

Unit-I **Practical circuit design issues and techniques:** Passive components, understanding and Interpreting data sheets and specifications of various passive and active components, design of electronic circuits by using these types of components, understanding and interpreting data sheets and specifications of various CMOS and TTL logic devices. CMOS/TTL interfacing issues, benefits and challenges on migration of 5V to 3.3V low voltage supplies.

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12 hrs **Unit-II** 

Power supply design techniques: Regulated and unregulated power supply, conditions for proper operation of Zener regulator, transistor series voltage regulator, transistor Shunt voltage regulator, short circuit protection, foldback protection circuit, IC voltage regulators, fixed voltage regulators, adjustable voltage regulators design, dual voltage regulators design, differences between linear voltage power supply and SMPS.

> **Unit-III** 12 hrs

Amplifiers design challenges and techniques: Basic amplifiers design, single stage amplifier, how transistor amplifies? Transistor audio power amplifier, small signal and large signal amplifier, difference between voltage and power amplifiers, operational amplifiers, circuit analysis using operational amplifier in different configurations.

> **Unit-IV** 10 hrs

Department of Electronics & Communication

Page 72

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Cooling and grounding of electronic system: Heat transfer approach to thermal management, mechanisms for cooling, basic thermal calculations, heat sink selection, and heat sink design. Safety grounds, signal grounds, high frequency ground methods, low frequency grounding methods, chassis grounding.

RECOMMENDED BOOKS												
Title	Author	Publisher										
1. Electronic Instrument Design, 1st edition	Kim R. Fowler	Oxford University Press.										
2. Digital Design Principles& Practices, 3rd edition	John F. Wakerly	Prentice Hall										
3. Practical Analog Design Techniques	Adolofo Garcia and Wes Freeman	Seminar Materials										
4.The Art of Electronics	Paul Horowitz	Cambridge University Press, 2011										



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Hurwitz criterion, root locus technique, Nyquist, bode plots and state space analysis.  Course  1. Understand basics of control system theory and its role in engineering design.  2. Explain concept of poles and zeros of a transfer function and their effect on physical behavior of a system.  3. Analyze time domain and frequency domain behavior of systems.  4. Perform state variable analysis of systems and establish relationship between state variable representation and transfer functions.  Mapping of Course Outcomes with program outcomes														
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO2	3	1	1	1	1	0	0	1	1	1	1	0	3	2
CO3	3	3	2	2	1	0	0	1	0	0	1	0	3	2
CO4	3	3	3	1	1	1	1	1	0	3	2	0	3	2
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1. Modern Control Engineering	Ogata K	Prentice Hall, 5th Edition				
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2. Automatic Control Systems	Kuo BC	Prentice Hall, 9th Edition				
		2014				
3. Modern Control Systems Engineering,	Nagrath I J and Gopal	New age international, 3rd				
	M	Edition, 2014.				
4. Linear Control System	B S Manke	Khanna Publishers, 12th				
		edition				



	PEEC-621B Telecommunication Switching Systems and Networks															
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Obje-	Course Objectives The aim of this course is to study the basics of switching systems and telecommunication transmission, designing of multistage networks, signaling techniques, different networks, charging and routing plans. The course emphasis on different technologies used for design of switching systems such as electronic space division switching and time division switching.  Course Outcomes  1. Understand the operation of telephone system and assess the need for voice digitization.  2. Explain the working principle of switching systems involved in telecommunication switching.  3. Design multi-stage switching structures involving time and space switching stages.  4. Analyze the signalling techniques and develop the numbering and charging plan.															
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CO3	3	2	0	0	2	2	2	1	0	0	2	3	2	3		
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CO5	3	2	0	0	1	3	3	1	0	0	3	3	2	2		
	•	•	•	•		<u>Unit-I</u>	•	•	•	•	•		•	12 hrs		

**Telecommunications transmission**: Basic switching system, simple tele-phone communication. **Switching systems**: Stronger switching systems, cross bar switching, electronic switching – space division switching, time division switching –time division space switching, time division time switching, time multiplexed space switching, time multiplexed time switching, combination switching.

Unit-II 12 hrs

**Speech digitization & transmission**: Quantization noise, companding, differential coding, vocoders, pulse transmission, **Coding schemes:** Line coding, NRZ and RZ codes, Manchester coding, AMI coding, Walsh codes, TDM.

<u>Unit-III</u> 12 hrs

**Traffic engineering**: Grade of service and blocking probability telephone networks, subscriber loops, switching hierarchy and routing, transmission plans and systems, signalling techniques, in channel, common channel.



**Control of switching systems:** Call processing functions, common control, and stored program control (For all type of switching systems).

Unit-IV 12 hrs

**Telephone networks and signalling**: Introduction, subscriber loops systems, switching hierarchy, transmission and numbering plans, common channel signalling principles, CCITT signalling systems.

	RECOMMENDED BOOKS										
Title	Author	Publisher									
1.Telecommunications	Flood J E	Pearson education Asia, (2001).									
Switching, Traffic and											
Networks											
2.Telecommunication	Viswanathan T	PHI, India, (2003).									
Switching Systems and											
Networks											
3.Signaling in	Bosse J G van, Bosse	Wiley, John & Sons, (1997).									
Telecommunication Networks	John G										
4. Switching in IP Networks:	Bruce S. Davie, Paul	Elsevier Science & Technology Books,									
IP Switching, Tag Switching,	Doolan, Yakov Rekhtor	(1998)									
and Related Technologies											
5. Switching and Traffic	Joseph Yu Hui	Kluwer Academic Publishers, (1990).									
Theory for Integrated											
Broadband Networks											



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CO2	3	3	3	3	3	2	2	1	0	0	1	2	3	2
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CO3	3	2	1	2	3	1	1	1	1	0	2	2	1	3
CO4	3	2	2	3	3	1	2	1	1	0	1	1	1	3
CO5	3	2	3	3	3	0	0	1	0	0	1	2	2	2
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	_	r Integrated	Circuit Lab	G 124
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Course	This lab includes complete ar	nalytical as we	ll as designing	circuits using op-amp. It includes
<b>Objectives</b>	design of various application	ns using op-ar	np as integrate	or, differentiator, log, antilog and
	wave generation circuits.			
Course	1. Examine the performance of	of op-amp in i	nverting as wel	l as in non-inverting modes.
<b>Outcomes</b>	2. Design of various applicati	ons using op-	amp.	
	3. Design different wave gene	erating circuit	s using op-amp	
	4. Design of 555 timer and Pl	LL circuit.		
	Mapping of Cours	se Outcomes	with program	outcomes

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CO2	3	3	3	3	3	2	2	1	3	2	1	2	3	2
CO3	3	3	3	3	3	2	2	1	3	2	1	2	3	3
CO4	3	2	2	2	3	2	2	1	3	2	1	2	3	2

# **List of Experiments:**

PO1

PO<sub>2</sub>

- 1. Design and analyze RC-circuit as low pass and high pass using active filters.
- 2. Design and analyze RC-circuit as low pass and high pass using passive filters.
- 3. Verify the differential amplifier configurations.
- 4. Measure the performance parameters of an op-amp.
- 5. Application of op-amp as inverting and non-inverting amplifier.
- 6. Verify the frequency response of an op-amp.
- 7. Use the op-amp as summing, scaling & averaging amplifier.
- 8. Use the op-amp as instrumentation amplifier.
- 9. Design and analyze differentiator and integrator using op-amp.
- 10. Application of op-amp as log and antilog amplifier.
- 11. Application of op-amp as saw tooth wave generator.
- 12. Application of op-amp as Schmitt Trigger.
- 13. Design and analyze multivibrator circuits using 555.
- 14. To examine the operation of a PLL and to determine the free running frequency, the capture range and the lock in range of PLL.



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<b>Obje</b>	ctives	langi	uage fo	or num	erical o	compu	tations	and it	s appli	cation i	n engine	eering a	nd techi	nology			
Cour	se		nguage for numerical computations and its application in engineering and technology Understand basic commands, manage contents and develop programs in MATLAB Perform mathematical modeling in MATLAB.														
Outc	omes	2. F	Perform mathematical modeling in MATLAB.														
		3. E	Evaluate, analyze and plot results.														
										1 Outco							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2			
CO1	2	3	3	3	3	1	0	1	3	2	1	2	2	3			
CO2	2	3	3	3	3	1	2	1	3	2	1	3	2	3			
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CO4	2	1	3	3	3	3	2	1	3	2	1	3	3	3			

### **List of Experiments:**

- 1. Familiarizing with basic elements of MATLAB's desktop, MATLAB windows, MATLAB editor input-output, file types, general commands, variables, numbers, working with arrays of numbers and array arithmetic operations.
- 2. Write a MATLAB program to display a matrix. Also find its length, width, divergence, transpose and inverse.
- 3. Write a MATLAB program to calculate matrix addition, multiplication, division and eigen value calculations.
- 4. To study basic 2-D plots, style options, labels, title, legend, and other text objects, axis control, modifying plots specialized 2-D plots, layout of multiple plots, mesh and surface plots, 3-D plots.
- 5. Write a script file to calculate addition, subtraction, multiplication, division, square, square root, cube and cube roots of integer numbers.
- 6. Familiarizing with control flow structures branching statements, loops and their operators.
- 7. Write a script file to find the largest of three numbers (use if-elseif-else).
- 8. Generate a 10-by-10 matrix A = [akl], where akl = sin(k)cos(l). (use for loop)
- 9. The number  $\pi$  is divided by 2. The resulting quotient is divided by 2 again. This process is continued till the current quotient is less than or equal to 0.01. Write a script file to find the largest quotient that is greater than 0.01? (use while).
- 10. Write a script file to generate 5 different magic squares.
- 11. Fibonacci numbers are computed according to the following relation:
- 12.  $F_n = F_{n-1} + F_{n-2}$ , with  $F_0 = F_1 = 1$
- 13. Create a function for generating the Fibonacci numbers with user defined function as (function  $f = Fib_1(n)$ )
- 14. To study functions for numerical integration,
- 15. To study functions for differential and non-linear algebraic equations.
- 16. To study symbolic computation in MATLAB and evaluate symbolic expressions.

Department of Electronics & Communication

Page 80

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi Surinder Singh



#### MATLAB SIMULINK

- 1. To generate BASK signal and observe the frequency spectrum on MULTISIM software.
- 2. To generate BPSK signal and observe the frequency spectrum on MULTISIM software.
- 3. To generate BFSK signal and observe the frequency spectrum on MULTISIM software.
- 4. To setup the model for BPSK baseband modulation for scatter plot to observe the constellation on MATLAB/SIMULINK software.
- 5. To setup the model for QPSK baseband modulation for scatter plot on to observe the constellation on MATLAB/SIMULINK software.
- 6. To setup the model for BFSK baseband modulation for scatter plot on to observe the constellation on MATLAB/SIMULINK software.
- 7. To setup the BPSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.
- 8. To setup the QPSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.
- 9. To setup the BFSK model with AWGN channel and perform error rate calculation/BER plot on MATLAB/SIMULINK software.

Department of Electronics & Communication



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		to un	derstar	id vari	ous pra	actical	issues	and la	test tre	ends in t	he field	l. The st	udents	will be		
		able t	o troub	oleshoo	ot vario	ous eng	ineerii	ng faul	ts relat	ed to the	eir respe	ective fi	elds. Th	ey will		
			be able to learn ethical management practices.													
Cour	se		After successful completion of industrial training, the students should be able to													
Outco	omes		1: implement the technical skills as an individual and in team.													
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Cours	<u>se</u>	Th	e aim o	of this	course	is to ac	quire k	cnowle	dge of	discrete	e time s	systems	s, Z-trai	nsform,
<b>Object</b>	<u>etives</u>	dis	screte	Fourie	r trans	form	(DFT)	and	fast Fo	ourier	transfo	rm (F	FT) m	ethods.
		Im	plemer	ntation	and des	signing	of FIR	and II	R filter	s and r	ealizati	on of tl	neir stru	ictures.
		Th	e conc	ept of	multira	ite sign	al prod	essing	g and sa	ample i	ate con	nversio	n will	also be
		dis	scussed											
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Outco	mes	2.	Compu	te Z-tra	ansforn	n, DFT	and FF	T of d	iscrete	time sig	gnals.			
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CO2	3	3	3	3	3	0	1	1	2	0	0	2	2	3
CO3	3	3	3	3	2	1	1	1	1	0	1	2	1	3
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**Introduction**: Advantages of digital signal processing over analog signal processing and its applications; basic elements of digital signal processing systems, concept of frequency in discrete time sinusoidal and harmonically related complex- exponential signals, review of discrete-time signals and systems, analysis of discrete-time systems, discrete-time systems described by difference equation, correlation of discrete-time signals.

Unit-II 16 hrs

**Z-transform**: Introduction to Z- transform and inverse Z-transform, region of convergence, properties of Z transform, analysis and characteristics of LTI systems using Z- transforms.

**Discrete Fourier transform (DFT):** Introduction to DFT, inverse DFT, DFT as a linear transform, relationship of DFT with other transforms, properties of DFT, circular convolution, use of DFT in linear filtering, filtering of long sequences. efficient computation of the DFT, fast Fourier transform algorithm using decimation in time and decimation in frequency techniques.

Unit-III 16 hrs

**Implementation of discrete time system:** Structures for the realization of discrete-time systems, structure for FIR & IIR systems, fixed point and floating-point representations, effects of coefficient unitization, effect of round off noise in digital filters, limit cycles.

**Design of digital filters:** General consideration, linear phase FIR filters, design methods for FIR filters using windows, IIR filter design by impulse invariance, bilinear transformation and matched Z-transformation.



<u>Unit-IV</u> 06 hrs

Multirate signal processing: Introduction, interpolation and decimation.

**Wavelet theory:** Short time Fourier transform (STFT), Continious wavelet transform (CWT), Discrete wavelet transform (DWT) and Haar wavelet.

RECO	MMENDED BOOKS	
Title	Author	Publisher
1. Discrete Time Signal Processing, 3rd Edition 2014	Oppenheim A V & Sehafer R W	Prentice Hall
2. Digital Signal Processing, 4th Edition 2006	Proakis J G & Manolakis D G	Pearson
3. Signal & Systems, 2nd Edition 2009	Oppenheim A V, Willsky A S & Young I T	Wiley Eastern Ltd N. Delhi
4. Digital Signal Processing, 4th Edition 2013	S.K Mitra	Tata Mc-Graw Hill



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**Basic antenna parameters**: Radiation mechanism, radiation patterns, antenna beam area, antenna beam width, radiation intensity, gain, directive gain, power gain, directivity (D), antenna bandwidth, effective height, reciprocity theorem, self-impedance, mutual impedance, radiation resistance, front to back ratio, radiation power density.

**Radiation principles**: Retarded vector potential, isotropic radiators, near field and far field concept, radiation from a half wavelength dipole, power radiated by a current element and its radiation resistance.

Unit-II 12 hrs

**Wire radiators**: Voltage and current distribution, asymptotic current distribution in dipole, analysis of linear wire elements, Hertz dipole antenna, monopole radiators, resonant and non-resonant antennas.

**Special antennas**: Aperture antennas, E & H -plane horn antennas, pyramidal horn, lens and reflector antenna, frequency independent antennas, log periodic antenna, antenna measurements, microstrip antennas & their advantages, antenna for receiving and transmitting TV signals e.g. Yagi-Uda and turnstile antennas.

Unit-III 12 hrs

**Antennas array:** Introduction, linear uniform arrays of isotropic sources, principles of pattern multiplication. broadside arrays, end fire arrays, array pattern synthesis, uniform array, binomial array, Chebyshev arrays.

Unit-IV 12 hrs

**Propagation of radio waves**: Structure of ionospheric region, different modes of propagation: ground waves, space waves, space wave propagation over flat and curved earth, optical and radio horizons, surface waves and troposphere waves, wave propagation in the ionosphere, critical frequency, maximum usable frequency (MUF), skip distance, virtual height, radio noise of terrestrial and extra-terrestrial origin, effect of earth's curvature, duct propagation, troposphere scatter propagation.

## RECOMMENDED BOOKS

Department of Electronics & Communication

Vivek Harshey

Page 85

Sarbjeet Singh

Dilip Kumar

J.S. Ubhi



Title	Author	Publisher
1. Antennas	Kraus	Mc Graw Hill
2. Antennas	Balanis	Mc Graw Hill
3. Antenna and Wave Propagation	K D Parsad	Parkash Publications
4. Electromagnetic Waves and Radiating	K. G Balmain, E. C	PHI
Systems	Jordan	

Department of Electronics & Communication

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Page 86



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<u>Course</u> <u>Outcomes</u>	<ol> <li>Understand the physical and electrical properties of semiconductor materials an their use in microelectronic circuits.</li> <li>Gain knowledge about fabrication process and challenges.</li> <li>Describe various VLSI fabrication tools and techniques.</li> <li>Process integration for NMOS, CMOS and bipolar circuits.</li> </ol>											als and			
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	<u> </u>			Unit-	<u>·I</u>									10 hrs	
Introduction															

landscape, classification, scaling thick film, thin film and hybrid integrated circuits, crystal structures.

**Unit-II** 

Crystal growth: Bridgeman and Czochralski techniques, clean room basics- environment, infrastructure, advanced MOS cleaning, gettering etc.

Oxidation: Surface passivation using oxidation, dry oxidation, wet oxidation, kinetics of Silicon dioxide growth for, thick thin and ultrathin films, Oxidation technologies in VLSI and ULSI, characterization of oxide films, High k and low k dielectrics for ULSI.

> **Unit-III** 14 hrs

**Lithography:** Photo reactive materials, types of photoresists, pattern generation and mask-making, pattern transfer, lithography process steps.

**Diffusion and ion implantation:** Interstitial diffusion, substitutional diffusion, interstitially diffusion, diffusion equation, Fick's first law and second law, ion implant distribution, penetration range, nuclear stopping, electronics stopping, implantation damage and annealing.

Epitaxy and thin film deposition: Historical development and basic concepts, chemical vapour deposition (CVD), atmospheric pressure chemical vapour deposition (APCVP), vapour phase epitaxy (VPE), liquid phase epitaxy (LPE), molecular beam epitaxy (MBE),

> **Unit-IV** 14 hrs

Etching: Historical development and basic concepts, wet etching, selectivity, isotropy and etch bias, common wet etchants, orientation dependent etching effects.

Metal film deposition: Evaporation and sputtering techniques, Failure mechanisms in, metal



interconnects and multi-level metallization schemes.

RECOM	IMENDED BOOKS	
Title	Author	Publisher
1.The Science and Engineering of	Stephen A. Campbell	Oxford University Press
Microelectronic Fabrication		
2. Fundamentals of Semiconductor	S. M. Sz	Wiley, 2003
Fabrication		
3.Introduction to Microelectronic	Richard C Jaeger	Prentice Hall, 2002
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CO2	3	3	3	3	3	2	0	1	2	2	3	0	2	3
CO3	3	3	2	2	3	0	1	1	2	2	3	0	2	3
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Passive network components & sensors: Introduction, couplers/splitters, WDM multiplexers, demultiplexers, filters, isolators, circulators, attenuators, electro-optic modulators, acousto-optic modulators and their application areas, optical sensors: classification-point, distributed, intensity, phase & spectral. smart structures & applications

Optical amplifiers and integrated optics: Introduction, semiconductor optical amplifiers (SOA), erbiumdoped fiber amplifiers (EDFA), fiber Raman amplifiers (FRA), application areas of optical amplifiers, some integrated optical devices, OEICs, optical bi-stability and digital optics, optical computation.

> **Unit-IV** 12 hrs



**Optoelectronic integrated circuits:** Introduction, hybrid and monolithic integration, application of opto electronic integrated circuits, integrated transmitters and receivers, guided wave devices.

RECOMMENDED BOOKs											
Title	Author	Publisher									
1. Semiconductor Optoelectronic Devices	Pallab Bhattacharya	Pearson Education Inc									
2. Photonics - Optical Electronics in Modern Communications	A. Yariv and P. Yeh,	Oxford University Press									
3.Opto Electronics – As Introduction to materials and devices	Jasprit Singh	McGraw-Hill International									
4.Opto Electronics – An Introduction	J. Wilson and J. Haukes	Prentice Hall, 1995									



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			3.	Realiz	ze pro	tocols	at dif	ferent	layers o	of a netv	vork hi	erarchy	•	
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CO2	3	2	3	3	2	2	2	1	0	0	2	2	1	2
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TCP/I	P mode	els, cor	nparis	son of	OSI a	and TO	CP/IP.							
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						<u>Unit-</u>	<u>III</u>							14 hrs
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Title Author Publisher

1. Data Communication and Networking

2. Computer Networks A.S Tanenbaum 4th Ed., Pearson Education.

3. Data and Computer W. Stallings 8th Ed., Prentice-Hall Communication



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Microwave components and tubes: Introduction to microwaves, microwave frequency spectrum, wave guides-basic concepts and properties, ferrite devices, faraday rotation, isolators, circulators, detector mounts, magic tee, frequency meter, cavity resonator, microwave filters, directional couplers, loop directional couplers, two-hole directional coupler, phase shifters, attenuators, introduction to S parameters, microwave tubes- Problem with conventional tubesat microwave frequencies, two cavity klystrons, multi cavity klystron, reflex klystron, , magnetrons, travelling wave tube.

<u>Unit-II</u> 12 hrs

**Microwave devices and measurements:** Transistors, varactor diodes, step recovery diode, tunnel diode, Gunn diode, avalanche diode, IMPATT diode, TRAPPAT diode, PIN diodes, parametric amplifier, General measurement setup with microwave bench, measurement devices, power measurement, attenuation measurement, measurement of VSWR, measurement of impedance, measurement of Q of a cavity resonator, and set up for S parameter measurement.



<u>Unit-III</u> 12 hrs

**Introduction to radar systems** Basic principle, block diagram, operation and applications of radar, radar range equation, CFARs pulse repetition frequency and range ambiguities, **Doppler radar:** Doppler effect, moving target indicator (MTI) radar, delay line cancellers, blind speeds, multiple or staggered pulse repetition frequencies, range gated doppler filters, block diagram of digital signal processor, pulse doppler radar, non-coherent MTI; basic CW radar, FMCW radar, multiple frequency CW radar: block diagram and operation for the measurement of range

Unit-IV 12 hrs

**Radar Systems**: Radar transmitters, basic configurations: self-excited power oscillator, master oscillator power amplifier (MOPA), comparison of tubes for radar transmitters, modulators, pulse forming network, block diagram of radar receiver, mixers, duplexers, displays

**Tracking and scanning**: tracking with radar, sequential lobbing, conical scanning, block diagram and operation, simultaneous lobing or monopulse tracking radar, amplitude comparison monopulse radar, block diagram and description for one angular coordinate and two (angular azimuth and elevation) coordinates, phase comparison monopulse radar.

RECON	RECOMMENDED BOOKS											
Title	Author	Publisher										
1. Microwave and Radar Engineering	M Kulkarni	Umesh Publications, Delhi										
2. Foundation of Microwave Engg	R. E. Collin	Tata McGraw Hill										
3. Introduction to Radar Systems	Skolnik, M.	Tata McGraw-Hill, 2001										
4.Microwaves	K C Gupta	New Age International										
5. Elements of Electronic Navigation Systems	N. S. Nagaraja	Tata McGraw-Hill, 2000										
6. Introduction to Radar Engineering	Sen & Bhattachrya	РНІ										



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CO2	2	3	3	3	0	1	2	1	2	0	0	3	3	2
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**Introduction**: Evolution of computer, hardware, software and firmware, computer architecture, types of computer, different types of buses.

**Data representation**: Signed number representation, fixed and floating-point representations, character representation.

<u>Unit-II</u> 14 hrs

Computer instruction set: Introduction, opcode encoding, addressing modes, instruction types, data transfer, arithmetic, logical, program and system control, reduced instruction set computers, RISC vs CSIC, basic parallel processing techniques: instruction level, thread level and process level.

Unit-III 14 hrs

**Execution unit**: Introduction, general register and combinational shifter design, flag register, computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, booth multiplier, carry save multiplier, division - non-restoring and restoring techniques, floating point arithmetic, ALU design, bit slice processor, coprocessors.

**CPU control unit design**: Introduction, basic concepts, hardwired and micro-programmed design approaches, case study - design of a simple hypothetical CPU.



<u>Unit-IV</u> 14 hrs

**Memory organization**: Introduction, memory interleaving, characteristics of memory systems, main memory design, concept of hierarchical memory organization, cache memory: cache size vs block size, mapping functions, replacement algorithms, write policy, associative memory, virtual memory and memory management concepts.

**Peripheral devices and their characteristics**: Input-output subsystems, basic concepts programmed I/O, standard vs memory mapped I/O, I/O transfers - program controlled, interrupt driven and DMA, software interrupts and exceptions.

RECO	MMENDED BOOKS	
Title	Author	Publisher
Computer Organization and     Embedded Systems	Carl Hamachar, Zvonco Vranesic and Safwat Zaky	5th Edition, McGraw-Hill, 2002
2. Computer Organization and architecture – Designing for Performance	j	6th Edition, Pearson, 2003



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Cour	se	The	course	aims	to equi	p the	student	with	the bas	sic und	erstand	ling of	the or	perating
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CO2	2	2	1	2	2	0	2	1	2	0	0	2	1	1
CO3	3	3	3	3	2	2	2	1	3	0	2	3	2	2
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**Introduction**: Concept of power electronics, applications of power electronics, power electronic systems, power semiconductor devices, types of power electronic converters, power electronic modules.

**Semiconductor switching devices**: Review of thyristor, two transistor model of SCR and V-I characteristics, thyristor turn-on methods, thyristor ratings and protection, gate characteristics, series and parallel connections of SCR, other members of thyristor family-DIAC, TRIAC, GTO, power MOSFET, firing circuits for thyristors, thyristor commutation techniques.

Unit-II 12 hrs

**Power rectification**: Principle of phase control, classification of rectifiers, single phase and three-phase rectifiers, semi converters, full converters, freewheeling diodes, transformer utility factor, effect of source impedance on the performance of rectifier, dual converters.

<u>Unit-III</u> 12 hrs

**Inverters**: Introduction, single phase voltage source inverters, current source inverters, force-commutated thyristor inverters, voltage control in single phase inverters, PWM inverters, series inverters, single phase parallel inverters.

Unit-IV 14 hrs

**Choppers**: Principles of chopper operation, control strategies, types of chopper circuits, thyristor chopper circuits.

**Cyclo-converters:** Principle of cyclo-converter operation, step-up and step down cyclo-converter, three phase half wave cyclo-converters, output voltage equation for a cyclo-converter.



RECOMMENDED BOOKS												
Title	Author	Publisher										
1. Power Electronics-Circuits, Devices and Applications	M H Rashid	PHI, 2nd Edition (1998).										
2. Industrial Electronics	G K Mithal	Khanna Publishers, Delhi, 18th Edition (1998).										
3. Industrial Electronics	S N Biswas	Dhanpat Rai and Company, Delhi, 3rd Edition (2000).										
4. Power Electronics	P S Bhimbra,	Khanna Publishers, Delhi, 3rd Edition (2002).										
5. Power Electronics	M D Singh, Khanchanda K B	ani TMH, 6th reprint (2001).										

Department of Electronics & Communication



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CO2	3	3	2	1	1	1	2	1	1	0	3	0	0	3
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CO3	3	3	3	3	2	2	2	1	1	0	3	0	3	3
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Design of combinational circuits and implementation using multiplexers, decoders, ROM, PLA and PAL.

Unit-II 12 hrs

**Synchronous sequential circuits**: The finite state machine, design of single multimode and ring counters, Mealy state diagram, Moore state diagram, state transition tables, state reduction techniques, state assignments, synthesis of sequential circuits.

**ASM modules:** The algorithm state m/c, ASM charts, ASM tables, linking of ASM modules.

Unit-III 12 hrs

**Asynchronous sequential circuits**: Races, hazards, asynchronous, state diagrams, primitive flow tables, state reductions and row merging, design of asynchronous state.

Programmable logic devices: Introduction to CPLDs and FPGAs



<u>Unit-IV</u> 12 hrs

**Introduction to VHDL**: Overview of digital design with VHDL, basic language elements, data objects, classes and data types, operators, overloading, logical operators, VHDL representation of digital design entity and architectural declarations, introduction to behavioural, dataflow and structural models, applications of VHDL to FPGA design.

RECOM	RECOMMENDED BOOKS											
Title	Author	Publisher										
1. An Engineering Approach to Digital	Fletcher William, I	3 <sup>rd</sup> Indian reprint, PHI,										
Design		(1994).										
2. Digital Design	Morris Mano M	3 <sup>rd</sup> Edition, Pearson										
		Education (2002).										
3. VHDL-Analysis and Modeling of Digital	Navabi Z	McGraw Hill.										
Systems												
4. Fundamentals of Logic Design	Charles H. Roth Jr	4 <sup>th</sup> Edition, Jaico Publishers										
		(2002).										
5. VHDL for Programmable Logic	Skahill Kevin	1 <sup>st</sup> Indian Reprint, Pearson										
		Education (2004).										
6. Verilog HDL: A Guide to Digital Design	Samir Palnitkar	2 <sup>nd</sup> Edition, Prentice Hall										
and Synthesis		PTR										



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CO2	3	3	2	1	2	0	0	1	2		2	2	3	2	3
CO3	3	3	3	2	2	1	1	1	1		0	1	3	2	3
CO4	0	0	0	0	3	3	0	1	3		0	2	2	3	2
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			Title					Auth	or			]	Publish	er	
1.The Syster		Microco	ontrolle	r and E	mbedd	ed	M.Maz	zidi, JC	6 Maiz	idi	Pear	son Ed	ucation		

2. Embedded Systems

3. The 8051 Microcontroller

Raj Kamal

Kenneth J. Ayala

Tata McGraw Hill Pearson Education



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	The aim of this course is to study the basics of cellular systems, impart													
<b>Objec</b>	<u>Objectives</u> knowledge about the fading effects. The emphasis will be to analyze different													
	modulation techniques used for mobile communication and understand the concepts of CDMA and GSM wireless communication standards.													
			concep	ts of (	CDMA	and C	GSM v	vireles	s com	munica	tion sta	ndards.		
Cours	tourse 1. Understand the concept of cellular system.													
Outco	<u>omes</u>		2. Dis	stingui	sh bet	ween o	differe	nt type	es of f	ading ir	n wirele	ss comi	municat	tion.
			3. An	alyze	variou	s mod	ulatior	techr	niques	used in	wireles	ss comn	nunicat	ion.
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CO2	1	2	3	3	1	2	0	1	1	2	2	2	2	2
CO3	3	2	1	2	2	2	1	1	1	1	2	3	2	2
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**Introduction to wireless communication systems**: Concept of cellular communication system, basics of wireless cellular system, mobile unit, base station, mobile switching centre, frequency reuse, channel assignment strategies, co-channel interference, determining the frequency reuse distance, hand-off strategies, interference and system capacity, trunking efficiency, improving capacity of cellular system, cell splitting and sectoring.

Unit-II 12 hrs

**Mobile radio propagation**: Introduction to radio wave propagation, free space propagation model, basic propagation mechanisms, reflection, diffraction, scattering, outdoor propagation models, indoor propagation models, signal penetration into buildings, types of small-scale fading, fading effects due to Doppler spread and delay spread, diversity techniques.

<u>Unit-III</u> 12 hrs

**Modulation techniques**: Introduction to linear modulation techniques, minimum shift keying, Gaussian minimum shift keying, spread spectrum modulation techniques, DS-SS, and FH-SS systems, performance of modulation schemes, power spectrum and error performance in fading channels.

Unit-IV 12 hrs

**Wireless communication standards**: Introduction to GSM, GSM services and features, system architecture, radio subsystem and channel types. cellular code division multiple access (CDMA) systems: principle, power control, effects of multipath propagation on code division multiple access and introduction to third generation wireless networks, long term evolution (LTE) and standards.

Department of Electronics & Communication

Page 101



]	RECOMMENDED BOOK	S
Title	Author	Publisher
1.Wireless Communications	T.S Rappaport	Pearson Education, 2003.
2.Principles of Mobile Communication	Gordon L. Stuber	Springer International Ltd., 2001.
3. Wireless Communications	Andrea Goldsmith	Cambridge University Press, 2007



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		digita	l time	causal s	systems	s. Later	r on, St	udents	will lea	arn hov	v to de	sign L	ow Pas	s, High
		Pass,	Band P	ass and	FIR fil	lter wit	th the h	elp of N	Matlab.			_		
Cours	<u>se</u>	1. Des	sign of	Discret	e time	causal	system.							
Outco	omes	2. Vei	rify var	ious ma	athemat	tical op	eration	s with	the help	of MA	TLAB	<b>3.</b>		
		3. De	sign of	digital	l FIR a	nd IIR	filters	using	differen	nt appr	oaches	and th	neir ass	ociated
		struct	ures.											
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			Mappi	ng of C	Course	Outco	mes wi	th prog	gram o	utcome	es			
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CO1	3	3	3	2	1	0	0	1	3	2	1	1	1	3
CO2	3	3	3	3	3	0	1	1	3	2	1	1	2	2
CO3	2	3	3	3	2	1	0	1	3	2	1	2	2	3
CO4	3	3	3	3	2	1	1	1	3	2	1	2	1	2

DCFC-713

# **List of Experiments:**

- 1. Write a program in Matlab to generate standard sequences.
- 2. Write a program in Matlab to compute power density spectrum of a sequence.
- **3.** To write a Matlab program to verify correlation and autocorrelation.
- **4.** Write a program in Matlab to verify linear convolution.
- **5.** Write a program in Matlab to verify the circular convolution.
- **6.** To write a Matlab programs for pole-zero plot, amplitude, phase response and impulse response from the given transfer function of a discrete-time causal system.
- 7. Write a program in Matlab to find frequency response of different types of analog filters.
- 8. Write a program in Matlab to design FIR filter (LP/HP) through Rectangular Window technique.
- 9. Write a program in Matlab to design FIR filter (LP/HP) through Triangular Window technique.
- 10. Write a program in Matlab to design FIR filter (LP/HP) through Kaiser Window technique.
- 11. Write a program in Matlab to find the FFT.
- 12. Implementation of low-pass, high pass and band-pass filter on some chosen signal.



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Obje	ctives	in mi	crowav	e range	e. It inc	ludes 1	their de	sign, g	gain, dii	rectivit	y, VSV	VR and	variou	is other
		chara	cteristic	s. Furt	her in	this lat	studei	nts wil	l attain	the kn	owledg	ge abou	it opera	ation of
		variou	ıs Plane	e-Tee.										
Cour	<u>se</u>	1. Eva	aluate g	ain, dir	ectivity	and o	ther ant	enna p	aramete	ers.				
Outc	omes	2. Me	asure th	ne impe	edance	matchi	ng char	acteris	tics of a	ntenna	s.			
	2. Measure the impedance matching characteristics of antennas.  3. Analyze the performance waveguide components.													
		4. Des	sign an	efficie	nt anten	na for	RF and	micro	wave fr	equenc	y range	e.		
			Mappi	ng of C	Course	Outco	mes wi	th pro	gram o	utcome	es			
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CO3	3	3	3	3	2	2	1	1	3	2	1	3	1	3
CO4	3	3	3	2	3	2	2	1	3	2	1	3	2	2

## **List of Experiments:**

- 1. To understand the working of the Motorized antenna trainer.
- 2. To investigate the properties of a Yagi antenna comprising a dipole and a parasitic element.
- 3. To know the form of a Yagi antenna and examine multi element antenna. To see how gain and directivity increase as element numbers increase.
- 4. To investigate the gain, and directivity of the log Periodic antenna over a wide frequency range.
- 5. To plot the radiation pattern of a directional antenna.
- 6. To measure antenna parameters (directivity, gain, beam width, half power beam width, front to back ratio) with polar plot of dipole antenna.
- 7. To measure antenna parameters of monopole antenna.
- 8. To measure antenna parameters of patch array antenna.
- 9. Identification of different waveguide components.
- 10. Study of the characteristics of klystron tube and to determine its electronic tuning range.
- 11. By use of slotted waveguide, to observe how the load impedance affects the VSWR.
- 12. To measure the VSWR of the antenna.
- 13. To determine the frequency & wavelength in a rectangular waveguide working on  $TE_{10}$  mode.
- 14. To be familiar with the operation of directional coupler.
- 15. To determine the standing wave-ratio and reflection coefficient.
- 16. To be familiar with the operation of E Plane-Tee.
- 17. To be familiar with the operation of H Plane-Tee.
- 18. To be familiar with the operation of Magic-Tee.
- 19. Measurement of the gain of horn antenna using Method of the two antennas.
- 20. To measure antenna parameters of horn (E, H, Pyramidal) & open waveguide antenna.
- 21. To measure antenna parameters of conical horn antenna.
- 22. To setup a satellite communication link.

Page 104



							PREC-							
		1			Pro	oject S	tage I	and Se	<u>eminar</u>	· ·				
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<b>Objec</b>	<u>tives</u>	forerunner to the full-fledged project work to be taken subsequently in 7 <sup>th</sup> semester. The												
		project work shall consist of substantial multidisciplinary component												
Cours	<u>se</u>	Upon completion of the project, the students will be able to												
Outco	mes	1. Select a suitable project making use of the technical and engineering knowledge gained												
		from previous courses with the awareness of impact of technology on the society and												
		their ethical responsibilities.												
		2. Co	ollect a	nd diss	eminat	te infor	mation	relate	d to sel	ected p	roject.			
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		pr	esentat	ion ski	lls with	n profe	ssional	ism.		•				
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Objec	ctives		various	routin	g proto	cols. T	he emp	hasis i	s also g	given to	study	the too	ols requ	uired in
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Cour	<u>se</u>		1. Unde	erstand	archite	cture a	nd addr	ess the	challen	iges for	wirele	ss sens	or netv	vorks.
Outco	<u>omes</u>		2. Anal	yze and	l simul	ate diff	erent ro	outing p	rotocol	s.				
			3. Unde	erstand	differe	nt topo	logies o	of wirel	ess sen	sor net	works.			
			4. Desi	gn sens	or netv	vorks us	sing so	ftware 1	tools.					
	_	_			of Cou	rse Ou	tcomes	with p	rogran					_
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CO1	3	2	0	0	1	1	1	1	0	0	2	3	3	2
CO2	3	3	3	3	3	1	1	1	1	0	2	2	2	2
CO3	3	2	1	2	3	1	1	1	1	0	1	2	2	2
CO4	2	2	0	0	3	1	1	1	1	0	2	3	3	2
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		T	itle				Au	thor				Publish	er	
1. Pro	tocols	and Ar	chitectu	res for		Holger	Karl	&	Andrea	s John	Wiley,	2005		
Wirel	ess Sen	sor Ne	tworks			Willig								
2. Wi	reless S	Sensor I	Networ!	ks- An		Feng Z	Zhao d	& Leo	nidas J	J. Elsev	ier, 200	)7		
Inforn	nation 1	Process	sing Ap	proach'	'	Guibas								
3. Wi	reless S	Sensor I	Networ	ks		Kazem	Soh	ıraby,	Danie	lJohn	Wiley,	2007.		
Techn	ology,	Protoc	ols, An	d		Minoli	, & Tai	ebZnat	i,		-			
Appli	cations	", John	Wiley,	2007.										

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Cours	<u>se</u>	Thi	s cours	e prov	ides fu	ndame	ntal kno	owledg	ge abou	ıt orbit	tal the	ory and	l satell	ite link
Object	tives	desi	ign. Stu	ıdents	will u	ndersta	nd the	role o	of vario	ous mo	odulatio	on, mu	ltiplexi	ng and
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CO4	3	3	2	2	3	0	1	1	2	0	2	3	2	2
						Unit-I		<u> </u>			1			12 hrs
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**Introduction:** Origin and brief history of satellite communication, satellite frequency bands for communication, current state of satellite communication.

**Orbital theory:** Orbital mechanism, locating the satellite in the orbit with respect to earth, look angle determination, azimuth and elevation angle calculations.

<u>Unit-II</u> 12 hrs

**Satellites and satellite link design:** Satellite subsystems, attitude and orbit control system, telemetry, tracking and command (T&C), communications subsystems, transponders, satellite antennas, satellite link design: basic transmission theory, noise figure and noise temperature, design of downlinks, satellite systems using small earth stations, uplink design, design of satellite link for specified (C/N).

Unit-III 12 hrs

**Modulation, multiplexing, multiple access techniques**: FM modulation, analog FM transmission by satellite, S/N ratio for satellite FM video transmission; digital transmission, baseband and bandpass transmission of digital data, digital modulation: BPSK, QPSK; multiplexing: FDM, TDM; access techniques: FDMA, TDMA, CDMA.



<u>Unit-IV</u> 12 hrs

**Propagation effects and satellite services**: Quantifying attenuation and depolarization, atmospheric absorption, cloud attenuation, rain and ice effects, prediction of rain attenuation. VSAT technology, direct broadcast satellite (DBS) for TV and radio, satellite navigation and GPS system, mobile satellite services.

RECOMMENDED BOOKS												
Title	Author	Publisher										
1.Satellite Communications	Timothy Pratt, Charles W. Bostian, Jeremy Allnutt	John Wiley & Sons, 2002										
2.Satellite Communications Systems: Systems, Techniques and Technology	Gerard Maral, Michel Bousquet	John Wiley & Sons Ltd, 2002										
3. Communication satellite systems	J Martin	Prentice Hall publication, 1978										
4.Satellite Communication	Dennis Roddy	McGraw-Hill, 4th Edition 2006.										



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					3		(	)		0			3	
			Sessi	onal M	larks							5	50	
			End	Semest	ter Exa	aminati	ion M	arks				5	50	
Course O	<u>bjecti</u>	ves						-		techniqu			_	
			the fu	ndame cteristi	ntal de	evice ph	ysics,	proces	ssing te	c design chniques oth in th	and tra	nsistor	level	ts with
Course O	utcom	ie:	0	f variou	ıs desi	gn para	meter.			cs of Mo			•	ortance
	<ol> <li>Analyze the DC and static behavior of basic CMOS logic circuits.</li> <li>Understand the basics of CMOS fabrication process, its requirements and challenges.</li> <li>Calculate and optimize the performance metrics of CMOS circuits.</li> </ol>													
Mapping of Course Outcomes with program outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	0	1	1	0	0	1	2	1	1
CO2														
CO3	3	2	2	3	3	2	1	1	1	2	2	2	1	2
CO4	3	3	2	3	3	0	1	1	2	1	3	2	2	3
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Introduction representation Threshold Capacitors	tion. I voltag	Physica ge, bod	l repre y effec	sentati t. MOS	on MC	OS trans e desigr	sistor t n equa	heory	. NMOS	S and Pl	MOS er	hancen	nent tran	nsistor.
						nit-II								16 hrs
The comp Tristate in		•											MOS in	verter,
						it-III								8 hrs
Review of Interconner prevention	ect and				proce	ss, layo								ng and
· · ·						it-IV								8 hrs
characteri	Circuit characterization and performance estimation resistance and capacitance estimation, Switching characteristics, CMOS gate transistor sizing, power dissipation. Basic physical design of simple logic gates. CMOS logic structure													
	RECOMMENDED BOOKS													
			Γitle					Auth				Publish	er	
1. Desi					rated C	ircuits		ad Ra			3raw-Hi			
2. Mic	roelect	ronics	Circuit	S			Sedra	a & Sr	nith	Oxfo	ord Univ	versity I	Press	



3. Principles of CMOS VLSI Design	Neil H.E Weste	John Wiley, 1994
4. CMOS Digital Integrated Circuits	Sung-Mo Kang	McGraw-Hill, 2003

Department of Electronics & Communication



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					Fibr	e Opti	cs Com	munic	ations					
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		Ses	sional	Marks	}								4	50
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Objec	tives	cor	nponen	ts for f	ibre coi	nmuni	cation s	system	s. Anal	yzation	of var	ious no	nlinear	effects
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Cours													canon	system.
Outco	<u>mes</u>		•		arious n			-			•			
					e long-h					d by us	ing opt	ical am	ıplifier.	
		4.	Describ	e the v	arious o	optical	networ	k topol	logies.					
		5.	Use the	appro	priate s	tate-of	-the-art	engin	eering	referen	ces and	l resou	rces ne	eded to
			find the	e best s	olutions	s to opt	tical sys	stem de	esign pi	roblems	<b>5.</b>			
		I .	Ma	pping	of Cou	se Ou	tcomes	with p	rogra	m outco	omes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	3	3	0	2	1	0	0	1	3	2	3
CO2	3	3	3	3	3	2	0	1	2	0	2	3	2	2
						_		_			_		_	
CO3	3	3	2	2	3	0	1	1	2	0	0	3	2	2
CO4	3	3	3	3	2	1	2	1	2	0	3	3	1	1
CO5	3	3	3	3	3	1	0	1	2	0	3	3	2	3
	1	-I	1	I	1	Unit-	<u> </u>	I	1		I	1		12 hrs

**Introduction to fiber optic**: Historical of fiber optics, block diagram of fiber optical communication, key elements of optical fiber system. standard for optical communication.

**Optical fibers**: Basic optical law and definitions, fiber characteristics and transmission, Types of fibers single mode and multimode, step index and graded index, numerical aperture, modes.

<u>Unit-II</u> 12 hrs

**Attenuation and dispersion**: Attenuation causes and measurement of attenuation, absorption, bending losses, dispersion (intermodal and intermodal), group velocity dispersion, dispersion induced pulse broadening, higher order dispersion, dispersion slope,

**Nonlinear effects**: Stimulated Raman scattering, stimulated Brillouin scattering, cross phase and self-phase modulation, four wave mixing



### <u>Unit-III</u> 12 hrs

**Optical source**: Energy bands, intrinsic and extrinsic material, P-n junction, direct and indirect band gaps, LED, structure, material, quantum efficiency, power and modulation, LASER diodes, principle of operation, laser diode rate equations, quantum efficiency, structure and modulation.

**Optical receivers:** Principle of PIN photo detector and avalanche photodiode, photo detector noise, detector response time, RAPD, avalanche multiplication noise, temperature effects, comparison of photo detectors.

<u>Unit-IV</u> 12 hrs

**Optical amplification**: Introduction to optical amplifier, characteristics of semiconductor optical amplifiers (SOAs), Erbium doped fibre amplifiers (EDFAs) and Raman amplifier and their gain characteristics and gain saturation.

**Optical networking**: fibre optics topologies, fibre distributed data interface (FDDI) structure, synchronous optical network (SONET) and SDH, SONET Ring, networking components.

RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Fiber-Optic Communication Systems	G. P. Aggarwal	J. Wiley & Sons. 2 <sup>nd</sup> Ed., 1997									
2. Optic Communication Systems	Mynbaev	Pearson education, 2001,									
3. Optical Fiber Communication	Gerd Keiser	McGraw Hill, 5 <sup>th</sup> edition 2013									
4. Optical Fiber Communication	Senior	PHI									



	PEEC-722B Electronic Measurements and Instrumentation  L T P Credits														
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Obje Cour	Course Objectives Aim of the course is to study the basics of unit, dimensions and standards. It also gives deep insight to PMMC instrument and bridges. It discusses as to how the analog data is converted to digital and vice versa. It also discusses the CRO and concept of signal generator and analyzer.  Course Outcomes  Aim of the course is to study the basics of unit, dimensions and standards. It also discusses as to how the analog data is converted to digital and vice versa. It also discusses the CRO and concept of signal generator and analyzer.  2. Understand the working of PMMC and other instruments.														
Oute	<u>omes</u>		<ol> <li>Ur app</li> <li>De</li> </ol>	ndersta plicatio	nd bri ons. the wo	dge th	eory,	worki	ng of	A/D ar	nd D/A	conver			
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	2	0	1	2	2	0	1	0	0	0	2	2	1	
CO2	0	3	2	1	2	2	2	1	0	0	0	2	2	1	
CO3	0	3	2	1	2	2	0	1	0	0	1	2	2	1	
CO4	0	3	2	1	2	2	2	1	0	0	1	2	2	3	
	•	•	•	•		Unit-I				•	•		•	12 hrs	

Unit, dimensions and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, other unit systems, dimension and standards. measurement errors: gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter.

Unit-II 12 hrs

**Electronic Meters**: Digital voltmeter systems, digital multimeter, digital frequency meter system, voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter.

Unit-III 12 hrs

**Analog to digital converter**: Transfer characteristics, A/D conversion technique: simple potentiometer and servo method, successive approximation method ramp type, integrating and dual slope integrating method. D/A converter: transfer characteristic, D/A conversion technique, digital mode of operation, performance characteristics of D/A convertors.

Unit-IV 12 hrs

**CRO**: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency and phase by CRO, oscilloscope probes, oscilloscope specifications and performance.

**Signal generator, analyser and recorders:** sine wave, non-sinusoidal signal and function generators, frequency synthesis techniques and digital signal generators, spectrum analyzer and distortion, concept of ECG, EMI, EMC, and EEG etc, X-Y recorders, plotters.



RECOMMENDED BOOKS									
Title	Author	Publisher							
Electronic Instrumentation and Measurements	David A. Bell	2nd Ed., PHI, New Delhi,2008							
2.Electronic Measurements and instrumentation.	Oliver and Cage	TMH, 2009							

Department of Electronics & Communication



						P	<b>EEC 72</b>	2C									
					Neura	l Netwo	orks and	d Fuzzy	Logics	;							
			L T P										Credits				
				3			0			0			3				
Sessional Marks													50				
End Semester Examination Marks													50				
Course The course will cover a variety of contemporary approaches to neural													netwo	rks and			
Objectives   fuzzy logic for various applications and introduce the underlying																	
0.0.00	Fundamental concepts of neural networks and fuzzy logic are covered in detail. A											_					
taking this course, the student will be ready to understand the structure, design																	
training of neural network and fuzzy logic based systems and will be competent																	
enough to apply these algorithms for the solution of a wide variety of problems																	
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Cours	20				the pr	incinle	of artifi	icial int	elligen	ce and	its reali	ization	using a	rtificial			
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Outco	<u> </u>	/				·king o	f multi	ilaver f	eed-fo	rward -	artificie	al neur	al netv	vork ac			
2. Describe the working of multilayer feed-forward artificial neural network											voik as						
universal problem solver.  3. Understand the concept of fuzzy logic.																	
1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -																	
4. Apply fuzzy logic system to solve real-world problems.  Mapping of Course Outcomes with program outcomes																	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2			
CO1	2	2	2	3	3	1	1	0	0	0	3	3	3	3			
COI					•	_	_				•						
CO2	3	3	2	1	3	2	1	1	1	3	3	3	3	3			
			1	_	<u> </u>	_	<u> </u>		_					1			
CO3	2	3	2	2	2	0	0	1	1	2	2	3	3	3			
CO4	3	2	2	1	3	0	0	3	2	1	2	3	3	3			
	1				1	Unit-I		1	ı	1	1		1	14 hrs			

**Neural network fundamentals**: Artificial intelligence, human brain, neural networks, neuron physiology, artificial neuron model, artificial neural network, artificial neural network architecture, network topologies, ANN parameters, learning methods, supervised learning, unsupervised learning, reinforced learning, competitive learning, delta rule, gradient descent rule, hebbian learning, Rosenblatt's perceptron, ADALINE and MADALINE Networks.

Unit-II 12 hrs

**Back-propagation networks**: Back-propagation network architecture, perceptron model, perceptron learning procedure, single layer artificial neural network, multilayer perceptron model, back-propagation learning, mathematical analysis, learning rate and momentum.

Unit-III 10 hrs

**Fuzzy logic**: Fuzzy set theory, fuzzy versus crisp, crisp sets, operations on crisp sets, fuzzy set, membership functions fuzzy set operators, crisp relation, cartesian product, operations on relations, fuzzy cartesian product, operations on fuzzy relations.

<u>Unit-IV</u> 12 hrs

**Fuzzy systems**: Propositional logic, propositional logic inference, predicate logic, predicate logic formula, predicate logic inference, fuzzy quantifiers, fuzzy inference, fuzzy rule-based system, defuzzification methods and fuzzy cruise-controller design.



RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Understanding Neural Networks	Stamatios V. Kartalopoulos	Prentice Hall of India									
and Fuzzy Logic		Private Limited, New Delhi,									
		2000									
2. Fuzzy Systems Design	Riza C.	Chand Publishers									
3. Neural Networks, Fuzzy Logics	S. Rajasekaran,	PHI Learning Private									
and Genetic Algorithms (Synthesis	G.A. VijaylakshmiPai	Limited, 2011									
and Applications).											



PREC-721															
Project Stage II															
		L T P									Credits				
				0				0		12			6		
Cours	<u>e</u>	An ability to write technical documents and give oral presentations related to the work												e work	
<b>Objec</b>	<u>tives</u>	completed and improve personality development and communication skills. Train the													
		students to approach ethically any multidisciplinary engineering challenges with													
		economic, environmental, and social contexts and to set them for future recruitment by													
		potential employers. Identify and apply appropriate well-rehearsed note-taking interactive													
		and time management strategies to their academic studies. Develop audience-centred													
		presentations meeting concrete professional objectives and integrating ethical and legal													
		visual aids. Identify and critically evaluate the quality of claims, explanation, support, and													
		delivery in public and professional discourse, and understand the factors influencing a													
			er's c												
Cours					-					_	of the t	echnical	and engi	neering	
Outco	mes								outcome				•		
											ntation	of the pr	roject.		
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	4. Communicate technical and general information by means of oral as well as written										written				
	presentation skills with professionalism.														
	5. Acquire problem solving, system integration, project management and documentation										entation				
skills.  Manning of Course Outcomes with pregram outcomes															
Mapping of Course Outcomes with program outcomes    PO1   PO2   PO3   PO4   PO5   PO6   PO7   PO8   PO9   PO10   PO11   PO12   PSO1   PSO2															
	PO1				1				PO9				PSO1	PSO2	
CO1	3	3	3	3	3	2	3	2	2	2	3	3	1	3	
CO2	3	3	3	2	2	1	2	3	2	2	3	0	3	3	
CO3	2	2	2	3	2	2	2	3	3	3	3	2	1	2	
CO4	3	3	3	3	3	3	0	3	2	3	2	3	1	2	
CO5	3	3	3	3	3	2	3	2	2	2	3	3	1	3	