Gurugram University Gurugram

Curriculum for UG Degree Course

in

Electronics and Communication Engineering

(Engineering &Technology)

Gurugram University Gurugram

GENERAL COURSE STRUCTURE & CREDIT DISTRIBUTION

STRUCTUREOFUNDERGRADUATEENGINEERINGPROGRAM

S.No.	Category	Breakup Of Credits
1	Humanities and Social Sciences including Management courses	11
2	Basic Science courses	21
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	28.5
4	Professional core courses	68
5	Professional Elective courses relevant to chosen specialization/branch	12
6	Open subjects–Electives from other technical and/or emerging subjects	12
7	Project work ,seminar and internship in industry or elsewhere	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	Non-credit
9	**Total**	**168.5**

SEMESTER WISE SUMMARY OF THE PROGRAM

S.No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	27	900	20.5 /19.5
2.	II	32	1000	23/24
3.	III	28	900	23
4.	IV	28	1000	22
5.	V	28	1100	23
6.	VI	28	900	22
7.	VII	27	900	21
8.	VIII	22	500	14
	Total	220	7200	168.5

COURSE CODE AND DEFINITIONS

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project

CREDITDISTRIBUTIONINTHEFIRSTYEAROFUNDERGRADUATE ENGINEERING PROGRAM

Bachelor of Technology Semester-I

Subject	Lecture (L)	Tutorial (T)	Laboratory/ Practical(P)	Total credits(C)
Communication Skills in English	2	0	0	2
Mathematics-I	3	1	0	4
Physics	3	1	0	4
Programing for problem solving using C	3	0	0	3
Basics of Environmental Science	2	0	0	2
Communication Skills in English(P).	0	0	2	1
Physics(P)	0	0	2	1
Programing for problem solving using C	0	0	2	1
Workshop Practices (P)	1	0	3	2.5
Sports (Audit Course) Compulsory	0	0	2	2*

ENGINEERING PROGRAM

Bachelor of Technology Semester-II

Subject	Lecture (L)	Tutorial (T)	Laboratory/ Practical(P)	Total credits(C)
Mathematics-II	3	1	0	4
Human Value & Soft Skills	2	0	2	3
Basic of Electrical and Electronics Engineering	3	0	0	3
Data Structure Using C	3	0	0	3
Object Oriented Concepts and Python Programming	3	0	0	3
Electronics Engineering-I	**3**	**0**	**0**	**3**
Basic of Electrical and Electronics Engineering(P)	0	0	2	1
Data Structure Using C(P)	0	0	2	1
Object Oriented Concepts and Python Programming (P)	0	0	2	1
Electronics Engineering-I Lab(P)	0	0	2	1

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

S.No.	Code No.	Course Title	Hours Per week			Total Credits	Semester
			L	T	P		
1		Communication Skills in English	2	0	2	3	I
2		Basics of Environmental Science	2	0	0	2	I
3		Human Value & Soft Skills	2	0	2	3	II
4		Organizational Behaviour	3	0	0	3	VII
					Total Credits	**11**	

BASIC SCIENCE COURSES (BSC)

S.No.	Code No.	Course	Hours Per Week			Total Credits	Semester
			L	T	P		
1		Physics	3	1	2	5	I
2		Mathematics-I	3	1	0	4	I
3		Mathematics-II	3	1	0	4	II
4		Mathematical & Computational Techniques	4	1	0	5	III
5		Probability Theory and Stochastic Processes	3	0	0	3	IV
					Total Credits	**21**	

ENGINEERING SCIENCE COURSE (ESC)

S.No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1		Programming for problem solving using C	3	0	2	4	I
2		Workshop Practices (P)	1	0	3	2.5	I
3		Data Structure Using C	3	0	2	4	II
4		Object Oriented Concepts and Python Programming	3	0	2	4	II
5		Electronics Engineering-I	3	0	2	4	II
6		Basic of Electrical and Electronics Engineering	3	0	2	4	II
7		MOOC – I (Essential)	3			3	VIII
8		MOOC – II (Essential)	3			3	VIII
					Total Credits	**28.5**	

PROFESSIONAL CORE COURSES (PCC)

S.No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Analog & Digital Communication Systems	3	0	2	4	III
2.		Electromagnetic Field Theory	3	0	0	3	III
3.		Digital Electronics	3	0	2	4	III
4.		Network Analysis and Synthesis	3	0	2	4	III
5.		Signal & Systems	3	0	0	3	III
6.		PCB Design & Workshop Lab	0	0	2	1	III
7.		Internet of Things	3	0	2	4	IV
8.		Microprocessors & Interfacing	3	0	2	4	IV
9.		Digital & Data Communication	3	0	0	3	IV
10.		Electronic Measurement & Instrumentation	3	0	2	4	IV
11.		Computer Organization & Architecture	3	0	0	3	IV
12.		Computer Networks	3	0	2	4	V
13.		Digital System Design	3	0	2	4	V
14.		Digital Signal Processing	3	0	2	4	V
15.		Wireless and Satellite Communication	3	0	2	4	V
16.		VLSI System Design	3	0	0	3	VI
17.		Microwave & Radar Engineering	3	0	2	4	VI
18.		Control System Engineering	3	0	2	4	VI
19.		Microcontroller & Embedded Systems	3	0	2	4	VII
					Total Credits	68	

PROFESSIONAL ELECTIVE COURSES (PEC)

S.No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1		Program Elective - I	3	0	0	3	V
2		Program Elective - II	3	0	0	3	VI
3		Program Elective - III	3	0	0	3	VI
4		Program Elective - IV	3	0	0	3	VII
					Total Credits	**12**	

OPEN ELECTIVE COURSES (OEC)

S.No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1		Open Elective -I	3	0	0	3	V
2		Open Elective -II	3	0	0	3	VI
3		Open Elective- III	3	0	0	3	VII
4		Open Elective - IV	3	0	0	3	VII
					Total Credits	**12**	

PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY OR ELSEWHERE

S.No.	CodeNo.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1		Practical Training-I	0	0	2	1	V
2		Project-I	0	0	4	2	VI
3		Practical Training-II	0	0	2	1	VII
4		Project-II	0	0	8	4	VII
5		Industrial Project/Project-III	0	0	16	8	VIII
					Total Credits	**16**	

Semester wise Structure and Curriculum for

UG Course in

Electronics and Communication Engineering

(Engineering & Technology)

Gurugram University Scheme of Studies and Examination
Bachelor of Technology (Electronics & Communication Engineering)

SEMESTER I

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total Marks
				L	T	P				
1	HSC	HSE-101	Communication Skills in English	2	0	0	2	30	70	100
2	BSC	BSM-103	Mathematics-I	3	1	0	4	30	70	100
3	BSC OR ESC	BSP-103 OR EEE-103	Physics OR Basic of Electrical Engineering	3	1	0	4 OR 3	30	70	100
4	ESC	CSE-101	Programming for problem solving using C	3	0	0	3	30	70	100
5	HSC	ENV-101	Basics of Environmental Science	2	0	0	2	30	70	100
6	HSC	HSE-101P	Communication Skills in English(P).	0	0	2	1	50	50	100
7	BSC OR ESC	BSP-103P OR EEE-103P	Physics(P) OR Basic of Electrical Engineering (P)	0	0	2	1	50	50	100
8	ESC	CSE-101P	Programming for problem solving using C (P)	0	0	2	1	50	50	100
9	ESC	MEE-102P	Workshop Practices (P)	1	0	3	2.5	50	50	100
10	Non Credit	AUS-101	Sports (Audit Course) Compulsory	0	0	2	-	-	-	-
TOTAL				27			20.5/ 19.5	350	550	900

*** Sports: Non-credit mandatory course.**

Gurugram University Scheme of Studies and Examination
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SEMESTER II

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total Marks
				L	T	P				
1	BSC	BSM-104	Mathematics-II	3	1	0	4	30	70	100
2	HSC	HSV-102	Human Value & Soft Skills	2	0	2	3	30	70	100
3	ESC OR BSC	EEE-103 OR BSP-103	Basic of Electrical Engineering OR Physics	3 3	0 1	0 0	3 OR 4	30	70	100
4	ESC	CSE-102	Data Structure Using C	3	0	0	3	30	70	100
5	ESC	CSE-106	Python Programming	3	0	0	3	30	70	100
6	ESC	ECE-102	Electronics Engineering-I	3	0	0	3	30	70	100
7	ESC OR BSC	EEE-103P OR BSP-103P	Basic of Electrical and Electronics Engineering(P) OR Physics	0	0	2	1	50	50	100
8	ESC	CSE-102P	Data Structure Using C(P)	0	0	2	1	50	50	100
9	ESC	CSE-106P	Python Programming (P)	0	0	2	1	50	50	100
10	ESC	ECE-102P	Electronics Engineering-I Lab(P)	0	0	2	1	50	50	100
Total				**32**			**23/ 24**	**380**	**620**	**1000**

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Bachelor of Technology (Electronics & Communication Engineering)

SEMESTER III

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total Marks
				L	T	P				
1	PCC		Analog & Digital Communication Systems	3	0	0	3	30	70	100
2	PCC		Electromagnetic Field Theory	3	0	0	3	30	70	100
3	PCC		Digital Electronics	3	0	0	3	30	70	100
4	PCC		Network Analysis and Synthesis	3	0	0	3	30	70	100
5	PCC		Signal & Systems	3	0	0	3	30	70	100
6	BSC		Mathematical & Computational Techniques	4	1	0	5	30	70	100
7	LC		Analog & Digital Communication Lab	0	0	2	1	50	50	100
8	LC		Digital Electronics Lab	0	0	2	1	50	50	100
9	LC		Network Analysis and Synthesis Lab	0	0	2	1	50	50	100
10	MC		Constitution of India	2	0	0	0	30	70	100*
Total				**28**			**23**	**330**	**570**	**900**

NOTE:

Constitution of India*: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree.

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SEMESTER IV

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total Marks
				L	T	P				
1	PCC		Internet of Things	3	0	0	3	30	70	100
2	PCC		Digital & Data Communication	3	0	0	3	30	70	100
3	PCC		Electronic Measurement & Instrumentation	3	0	0	3	30	70	100
4	BSC		Probability Theory and Stochastic Processes	3	0	0	3	30	70	100
5	PCC		Computer Organization & Architecture	3	0	0	3	30	70	100
	PCC		Microprocessor & Interfacing	3	0	0	3	30	70	100
7	LC		Internet of Things Lab	0	0	2	1	50	50	100
8	LC		Electronic Measurement & Instrumentation Lab	0	0	2	1	50	50	100
9	LC		Microprocessor & Interfacing Lab	0	0	2	1	50	50	100
10	LC		PCB Design & Workshop Lab	0	0	2	1	50	50	100
11	MC		Scientific & Technical writing Skills	2	0	0	-	30	70	100*
Total				28			22	380	620	1000

NOTE:

1. Scientific & Technical writing Skills: The examination of the regular students will be conducted by The concerned college/ Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree.
2. At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5thSemester.

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SEMESTER V

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	PCC		Computer Networks	3	0	0	3	30	70	100
2	PCC		Digital System Design	3	0	0	3	30	70	100
3	PCC		Digital Signal Processing	3	0	0	3	30	70	100
4	PCC		Wireless & Satellite Communication	3	0	0	3	30	70	100
5	PEC		Program Elective - I	3	0	0	3	30	70	100
6	OEC		Open Elective - I	3	0	0	3	30	70	100
7	LC		Computer Networks Lab	0	0	2	1	50	50	100
8	LC		Digital Signal Processing Lab	0	0	2	1	50	50	100
10	LC		Digital System Design Lab	0	0	2	1	50	50	100
11	LC		Wireless & Satellite Communication lab	0	0	2	1	50	50	100
12	PT		Practical Training-I	0	0	2	1	30	70	100
Total				28			23	410	690	1100

NOTE:

1. **Choose any one from Professional Elective Course – I**
2. **Choose any one from Open Elective Course – I**

PROFESSIONAL ELECTIVE- I (Semester-V)

Sr. No	Code	Subject	Credit
1.		Information Theory and Coding	3
2.		Antennas and Propagation	3
3.		Bio-Medical Electronics	3
4.		Introduction to MEMS	3
5.		Mobile applications development	3
6.		Analog Integrated Circuit	3

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Semester VI

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	PCC		Control System Engineering	3	0	0	3	30	70	100
2	PCC		Microwave & Radar Engineering	3	0	0	3	30	70	100
3	PEC		Program Elective - II	3	0	0	3	30	70	100
4	PEC		Program Elective - III	3	0	0	3	30	70	100
5	OEC		Open Elective - II	3	0	0	3	30	70	100
6	PCC		VLSI System Design	3	0	0	3	30	70	100
7	LC		Control System LAB	0	0	2	1	50	50	100
8	LC		Microwave & Radar Engineering Lab(P)	0	0	2	1	50	50	100
9	PROJ		Project-I	0	0	4	2	50	50	100
10	MC		Economics for Engineers	2	0	0	0	30	70	100*
Total				28			22	330	570	900

NOTE:

1. Economics for Engineers: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree.
2. At the end of the 6th semester, each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.
3. Choose any one from each Professional Elective Course – II & III
4. Choose any one from Open Elective Course – II

PROFESSIONAL ELECTIVE- II (Semester-VI)

Sr. No	Code	Subject	Credit
1.		Robotics & Automation	3
2.		Wireless Sensor Networks	3
3.		Mobile Communications	3
4.		Power Electronics	3

PROFESSIONAL ELECTIVE - III (Semester-VI)

Sr. No	Code	Subject	Credit
1.		Nano Electronics	3
2.		High Speed Electronics	3
3.		Biosensors	3
4.		Image Processing	3

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SEMESTER VII

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	PCC		Micro Controller & Embedded System	3	0	0	3	30	70	100
2	PEC		Program Elective-IV	3	0	0	3	30	70	100
3	OEC		Open Elective –III	3	0	0	3	30	70	100
4	OEC		Open Elective -IV	3	0	0	3	30	70	100
5	HSMC		Organizational Behaviors	3	0	0	3	30	70	100
6	LC		Micro Controller & Embedded System Lab	0	0	2	1	50	50	100
7	PROJ		Project-II	0	0	8	4	100	100	200
8	PT-II		Practical Training-II	0	0	2	1	50	50	100
Total				27			21	350	550	900

NOTE:

1. **Choose any one from Professional Elective Course – IV**
2. **Choose any one from each of the Open Elective Course – III & IV**

PROFESSIONAL ELECTIVE- IV (Semester-VII)

Sr. No	Code	Subject	Credit
1.		Optical Fibre Communication	3
2.		Neural Networks & Fuzzy Logic	3
3.		Telecommunication and Switching Networks	3
4.		Data Communication Networking & Security	3
5		Radar and Sonar	3
6		Error Correcting Codes	3
7		Digital Audio Processing	3

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SEMESTER VIII

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	ESC		MOOC –I (Essential)	3	0	0	3	25	75	100
2	ESC		MOOC-II (Essential)	3	0	0	3	25	75	100
3	PROJECT		Project – III/Industrial Training	0	0	16	8	150	150	300
Total				**22**			**14**	**200**	**300**	**500**

NOTE: At the end of the 8th semester, each student has to submit the certificate of MOOCs (Essential).

Gurugram University Scheme of Studies and Examination
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Semester III

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total Marks
				L	T	P				
1	PCC		Analog & Digital Communication Systems	3	0	0	3	30	70	100
2	PCC		Electromagnetic Field Theory	3	0	0	3	30	70	100
3	PCC		Digital Electronics	3	0	0	3	30	70	100
4	PCC		Network Analysis and Synthesis	3	0	0	3	30	70	100
5	PCC		Signal & Systems	3	0	0	3	30	70	100
6	BSC		Mathematical & Computational Techniques	4	1	0	5	30	70	100
7	LC		Analog & Digital Communication Lab (P)	0	0	2	1	50	50	100
8	LC		Digital Electronics Lab(P)	0	0	2	1	50	50	100
9	LC		Network Analysis and Synthesis Lab (P)	0	0	2	1	50	50	100
10	MC		Constitution of India	2	0	0	-	30	70	100*
Total				**28**			**23**	**330**	**570**	**900**

NOTE: Constitution of India*: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree.

ANALOG & DIGITAL COMMUNICATION SYSTEMS

Course Code					
Category	**Professional Core Courses**				
Course title	Analog & Digital Communication Systems				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : III**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To introduce the students to the basics of different types of modulation techniques
2. To aim at a comprehensive coverage of design of radio transmitter and receiver
3. The course aims to make the student familiar with Digital Modulation and Demodulation techniques, Digital transmission, reception etc.

UNIT I

Course Contents: Review of signals and systems, Frequency domain of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

UNIT II

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and Deemphasis, Threshold effect in angle modulation.
Pulse modulation.Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

UNIT III

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations.Baseband Pulse Transmission- Inter Symbol Interference and Nyquist criterion.
Bandpass Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.

UNIT IV

Information Measures: Discrete Source models – Memoryless and Stationary, Mutual Information, Self-Information, Conditional Information, Average Mutual Information, Entropy, Entropy of the block, Conditional Entropy, Information Measures for Analog Sources.

Course Outcomes: At the end of this course, students will demonstrate the ability to;

1. Illustrate the principles of amplitude and angle modulation techniques
2. Understand probability and random process.
3. Analyze the performance of waveform coding techniques.
4. Compare bandpass digital modulation techniques for bit error rate, bandwidth and power requirements
5. Understand the concept of information rate and channel capacity.
6. Understand the concepts of information measure.

Text/Reference Books:

1. B.P.Lathi,Zhi Ding “Modern Digital and Analog Communication”, Oxford, 4th Edition,2011
2. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
3. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
4. Taub H. and Schilling D.L., "Principles of Communication Systems",Tata McGraw Hill, 2001.
5. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.
6. R. Anand, Communication Systems, Khanna Book Publishing Company, 2011.

Electromagnetic Field Theory

Course Code					
Category	**Professional Core Courses**				
Course title	**Electromagnetic field Theory**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : III**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To introduce the basic mathematical concepts related to electromagnetic vector fields.
2. To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
3. To impart knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
4. To impart knowledge on the concepts of Faraday‘s law, induced emf and Maxwell‘s equations.
5. To impart knowledge on the concepts of Concepts of electromagnetic waves and Transmission lines.

UNIT I

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant, Characteristic impedance and reflection coefficient, Impedance Transformation, Loss-less and Low Loss Transmission line and VSWR, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines, Impedance Matching, Lossy transmission line, Problems on Transmission line, Types of transmission line.

UNIT II

Maxwell’s Equations- Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface.

Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Pioncere's Sphere, Wave propagation in conducting medium, Wave propagation and phase velocity, Power flow and Poynting vector, Surface current and power loss in a conductor Plane Waves at a Media Interface- Plane wave in arbitrary direction,

UNIT III

Plane wave at dielectric interface, Reflection and refraction at media interface, Total internal reflection, Polarization at media interface, Reflection from a conducting boundary.

Waveguides- Parallel plane waveguide,Wave propagation in parallel plane waveguide, Analysis of waveguide general approach,

UNIT IV

Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization and Attenuation in waveguide, Attenuation in waveguide continued.

Radiation- Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz, dipole, thin linear antenna, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna, Fourier transform relation between current and radiation pattern.

Course outcomes:

1. Appreciate the importance of transmission lines and analyse transmission line problems.
2. Solve Maxwell's equations to understand propagation of electromagnetic waves.
3. Analyse plane wave at dielectric interface.
4. Understand waveguides.
5. Analyse electromagnetic wave propagation in rectangular metallic waveguides and resonators.
6. Understand antenna characteristics, and design linear antennas and their arrays.

Text/Reference Books:

1. R.K. Shevgaonkar, „Electromagnetic Waves, Tata McGraw Hill India, 2005
2. R.L. Yadav, Electromagnetic Fields and Waves, Khanna Book Publishing, 2021
3. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
4.Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
5. David Cheng, Electromagnetics, Prentice Hall

DIGITAL ELECTRONICS

Course Code					
Category	**Professional Core Courses**				
Course title	**Digital Electronics**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : III**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To provide a comprehensive introduction to digital logic design leading to the ability to understand binary codes, binary arithmetic and Boolean algebra and its relevance to digital logic design.
2. To study number system and codes.
3. To design & analyze combinational circuits and synchronous sequential logic circuits.
4. To familiarize students with basics of digital logic families.

UNIT I

Number system and codes: Binary, octal, hexadecimal and decimal Number systems and their inter conversion, BCD numbers (8421-2421), gray code, excess–3 code, cyclic code, code conversion, ASCII, EBCDIC codes. Binary addition and subtraction, signed and unsigned binary numbers, 1's and 2's complement representation.

UNIT II

Boolean Algebra: Basic logic circuits: Logic gates (AND, OR, NOT, NAND, NOR, Ex-OR, Ex_NOR and their truth tables,), Universal Gates, Laws of Boolean algebra, De-Morgan's theorem, Min term, Max term, POS, SOP, K_Map, Simplification by Boolean theorems, don't care condition

Logic Families: Introduction to digital logic family such as RTL, DTL, TTL, ECL, CMOS, IIR, HTL etc., theircomparative study, Basic circuit, performance characteristics, Wired logic, open collector output etc

UNIT III

Combinational Logic: The Half adder, the full adder, subtractor circuit. Multiplexer demultiplexer, decoder, BCD to seven segment decoder ,encoders.

Flip flop and Timing circuit : set-reset laches, D-flipflop, R-S flip-flop, J-K Flip-flop, Master slave Flip flop, edge triggered flip-flop, T flip-flop.

UNIT IV

Registers & Counters: Synchronous/Asynchronous counter operation, Up/down synchronous counter, application of counter, Serial in/Serial out shift register, Serial in/Serial out shift register, Serial in/parallel out shift register, parallel in/ parallel out shift register, parallel in/Serial out shift register, Bi-directional register.

Course outcomes:

1. To present a problem oriented introductory knowledge of Digital circuits and its applications.
2. Learn Number system and codes.
3. Study Boolean algebra and theorems
4. To focus on the study of electronic circuits
5. Design and analyze combinational circuits.
6. Design and analyze synchronous sequential logic circuits.

Text/Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill.
2.Digital Fundamentals by Morris and Mano, PHI Publication
3 Fundamental of digital circuits by A.ANANDKUMAR,PHI Publication

NETWORK ANALYSIS AND SYNTHESIS

Course Code					
Category	**Professional Core Courses**				
Course title	**Network Analysis and Synthesis**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : III**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To give students knowledge of AC theorems
2. To make the students understand concepts of two port networks, and network synthesis.
3. To give the students a fair knowledge on the Laplace transforms
4. To understand filters.

UNIT I

Node and mesh analysis, matrix approach of network containing voltage & current sources and reactance's, source transformation and duality.

Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power transfer, compensation and Tallegen's theorem as applied to A.C. circuits.

UNIT II

Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

UNIT III

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

UNIT IV

Transient behavior, concept of complex frequency, driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and two four port network and interconnections, behaviour of series and parallel resonant circuits, introduction to band pass, low pass, high pass and band reject filters.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Understand Trigonometric and exponential Fourier series.
4. Apply Laplace transform for steady state and transient analysis.
5. Determine different network functions.
6. Appreciate the frequency domain techniques.

Text/Reference Books

1. Franklin F. Kuo, “Network Analysis and Synthesis,” Wiley India Education, 2nd Ed., 2006.
2. Van, Valkenburg, “Network analysis,” Pearson, 2019.
3. Sudhakar, A., Shyammohan, S. P., “Circuits and Network,” Tata McGraw-Hill New Delhi, 1994.
4. A William Hayt, “Engineering Circuit Analysis,” 8th Edition, McGraw-Hill Education.
5. A. Anand Kumar, “Network Analysis and Synthesis,” PHI publication, 2019.

SIGNALS AND SYSTEMS

Course Code					
Category	**Professional Core Courses**				
Course title	**Signals and Systems**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : III**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To bring the Continuous-time and Discrete-time concepts, types ofsignals and systems.
2. To impart knowledge about representation, properties and applications of systems andsignals.
3. To impart knowledge about transforms and their applications to signals and systems.

UNIT I

Introduction to signals and systems- Signals and systems as seen in everyday life, and in various branches of engineering and science electrical, mechanical, hydraulic, thermal, biomedical signals and systems as examples. Extracting the common essence and requirements of signal and system Formalizing signals- energy and power signals, signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. Formalizing systems- system properties: linearity: additivity and homogeneity, shift invariance, causality, stability, realizability.

UNIT II

Continuous time and discrete time Linear shift-invariant (LSI) systems in detail-the impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of linear shift invariant systems.System representation through differential equations and difference equations. Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality.

UNIT III

The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and Orthogonal bases of signals. Properties of DTFT and DFT.

The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems

UNIT IV

The Laplace Transform for continuous time signals and systems- the notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. Generalization of Parseval's Theorem.

Advanced topics: time-frequency representation and the uncertainty principle, Short-time Fourier Transforms and wavelet transforms.

Course outcomes:

1. Identify the sources of signals, and systems in real life.
2. Characterize different types of signals and systems.
3. Represent continuous-time and discrete-time systems in different mathematical forms.
4. Analyse system behaviour using time and frequency domain techniques.
5. Analyze Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT).
6. Characterize Laplace transform

Text/Reference books:

1. R. Anand, Signals and Systems, Khanna Publishing House, 2019.
2. A.V. Oppenheim, A.S. Willsky and I.T. Young,"Signals and Systems", Prentice Hall, 1983.
3. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
4. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
5. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998. 6. Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: c1999.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.

MATHEMATICAL & COMPUTATIONAL TECHNIQUES

Course Code					
Category	**Basic Science Courses**				
Course title	**Mathematical & Computational Techniques**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : III**
	4	**1**	**0**	**5**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To provide the numerical methods of solving the non-linear equations, interpolation, differentiation, and Integration.
2. This course is an introduction to a broad range of numerical methods for solving mathematical problems that arise in Science and Engineering.
3. The goal is to provide a basic understanding of the derivation, analysis, and use of these numerical methods

UNIT I

Interpolation by polynomials, error of the interpolating polynomial, piecewise linear and cubic spline interpolation. Numerical integration, Simpson rule, composite rules, error formulae, Gauss quadrature.

UNIT II

Solution of a system of linear equations, implementation of Gaussian elimination and GaussSeidel methods, partial pivoting, row echelon form, LU factorization, Cholesky's method, illconditioning, norms.

UNIT III

Solution of a nonlinear equation, bisection and secant methods.Newton-Raphson method, rate of convergence, solution of a system of nonlinear equations. Numerical solution of ordinary differential equations, Euler and Runge-Kutta methods, multistep methods, predictor-corrector methods, order of convergence,

UNIT IV

Finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations.Eigenvalue problem, power method, QR method, Gershgorin's theorem. Exposure to software packages like MATLAB.

Course Outcomes:

1. Understand different numerical integration techniques, and numerically solve differential equations.
2. Understand interpolation by polynomials.
3. Perform various matrix computations and solve simultaneous linear equations.
4. Find solution of nonlinear equation.
5. Find roots of a transcendental equation using different methods.
6. Implement different interpolation schemes.

Text/Reference Books:

1. S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980.
2. C. E. Froberg, Introduction to Numerical Analysis (2nd Edition), Addison-Wesley, 1981
3. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999).
4. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing (2022).
5. K. E. Atkinson, An Introduction to Numerical Analysis (2nd edition), Wiley-India, 1989
6. R. Agor, Elements of Mathematical Analysis, Khanna Publishing House, 2015.
7. Erwin Kreyzig ,Advanced Engineering ,Mathematics

DIGITAL ELECTRONICS LABORATORY

Course Code					
Category	**Laboratory Courses**				
Course title	**Digital Electronics Laboratory**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : III**
	0	**0**	**2**	**1**	
Class Work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hrs				

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

LIST OF EXPERIMENTS

1. To study of TTL gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
2. To design & realize a given function using K-maps and verify its performance.
3. To verify the operation of multiplexer & Demultiplexer.
4. To verify the operation of comparator.
5. To verify the truth tables of S-R, J-K, T & D type flip flops.
6. To study FLIP-FLOP conversion.
7. To verify the operation of bi-directional shift register.
8. To design & verify the operation of 3-bit synchronous counter.
9. To design and verify the operation of synchronous UP/DOWN decade counter using
10. J K flip-flops &drive a seven-segment display using the same.
11. To design and verify the operation of asynchronous UP/DOWN decade counter using
12. J K flip-flops &drive a seven-segment display using the same.
13. To design a 4-bit shift register and verify its operation.

Lab outcomes: At the end of this lab, student will be able to

1. To present a problem oriented introductory knowledge of Digital circuits and its applications.
2. Learn Number system and codes.
3. Study Boolean algebra and theorems
4. To focus on the study of electronic circuits
5. Design and analyze combinational circuits.
6. Design and analyze synchronous sequential logic circuits.

NETWORK ANALYSIS & SYNTHESIS LABORATORY

Course Code						
Category	**Laboratory Courses**					
Course title	**Network Analysis & Synthesis Laboratory**					
Scheme	**L**	**T**	**P**	**Credits**	**Semester : III**	
	0	**0**	**2**	**1**		
Class Work	50 Marks					
Exam	50 Marks					
Total	100 Marks					
Duration of Exam	02 Hrs					

Note:

1. At least 10 experiments are to be performed by students in the semester.
2. At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus
3. Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS:

1. Introduction of circuit creation & simulation software like MATLAB, TINAPRO etc.
2. Study of Transient response of RC, RL circuit.
3. To find the resonance frequency, Band width of RLC series circuit.
4. To calculate and verify "Z" & "Y" parameters and "ABCD" parameters of a two-port network.
5. To determine equivalent parameter of parallel-series, cascading and parallel connections of two port network.
6. To calculate and verify Compensation theorem and Tellegen's theorem.
7. To synthesize a network of a given network function and verify its response.
8. To calculate and verify Maximum power transfer and Reciprocity theorem.

Note: Use appropriate Software or simulation tool for experiments.

Lab Outcomes: At the end of this lab, students will demonstrate the ability to:

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Determine and verify different parameters.
4. Determine different network functions.

ANALOG & DIGITAL COMMUNICATION SYSTEMS LABORATORY

Course code					
Category	**Laboratory Courses**				
Course title	**Analog & Digital Communication Systems Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester : III**
	0	**0**	**2**	**2**	
Classwork	**50 Marks**				
Exam	**50 Marks**				
Total	**100 Marks**				
Duration of Exam	**02 Hours**				

Note:-

1 Total ten experiments are to be performed in the semester

2 At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed and set by the concerned institution as per the scope of the syllabus.

COURSE OBJECTIVES:

1. To provide the basic understanding about various modulation techniques.
2. To analyze different characteristic parameters of these modulation techniques.

LIST OF EXPERIMENTS:

1. To study and waveform analysis of amplitude modulation and determine the modulation index of amplitude modulation.
2. To study and waveform analysis of amplitude demodulation by any method.
3. To study and waveform analysis of frequency modulation and determine the modulation index of frequency modulation.
4. To study and waveform analysis of frequency demodulation by any method.
5. To study Amplitude Shift Keying (ASK) modulation.
6. To study Frequency Shift Keying (FSK) modulation.
7. To study Phase Shift Keying (PSK) modulation.
8. To study and waveform analysis of phase modulation.
9. To study Phase demodulation.
10. 10.To study Pulse code modulation.
11. To study Pulse amplitude modulation and demodulation.
12. To study Pulse width modulation.
13. To study Pulse position modulation.

COURSE OUTCOMES:

1. Students are able to analyze digital communication signals.
2. Understand modulation and demodulation concept.
3. Students understand the basics of PAM, QAM, PSK, FSK, and MSK.
4. They can analyze noise and disturbance in modulated signals.
5. Know the methods use for analog and digital communication

CONSTITUTION OF INDIA

Course code					
Category	Mandatory courses				
Course title	Constitution of India				
Scheme and Credits	L	T	P	Credits	Semester : III
	2	0	0	-	
Classwork	-				
Exam	-				
Total	-				
Duration of Exam	-				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT - I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

UNIT - II

Federal structure and distribution of legislative and financial powers between the Union and the States

UNIT - III

Organs of Governance: President – Qualification and Powers of the President, Governor- Qualification and Powers of Governor,

Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

UNIT - IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Rights to equality, right to freedom, right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

COURSE OUTCOMES: At the end of this course, students will demonstrate the ability to

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to a revolution in India.
3. Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.
4. Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail.
5. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
6. Discuss the passage of the Hindu Code Bill of 1956.

TEXT AND REFERENCE BOOKS:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

NOTE: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.

Gurugram University Scheme of Studies and Examination
Bachelor of Technology(Electronics & Communication Engineering)

Semester IV

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total Marks
				L	T	P				
1	PCC		Internet of Things	3	0	0	3	30	70	100
2	PCC		Digital & Data Communication	3	0	0	3	30	70	100
3	PCC		Electronic Measurement & Instrumentation	3	0	0	3	30	70	100
4	BSC		Probability Theory and Stochastic Processes	3	0	0	3	30	70	100
5	PCC		Computer Organization & Architecture	3	0	0	3	30	70	100
	PCC		Microprocessor & Interfacing	3	0	0	3	30	70	100
7	LC		Internet of Things Lab	0	0	2	1	50	50	100
8	LC		Electronic Measurement & Instrumentation Lab	0	0	2	1	50	50	100
9	LC		Microprocessor & Interfacing Lab	0	0	2	1	50	50	100
10	LC		PCB Design Lab	0	0	2	1	50	50	100
11	MC		Scientific & Technical writing Skills*	2	0	0	-	30	70	100*
Total				28			22	380	620	1000

NOTE:

1. Scientific & Technical writing Skills*: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree.

2. At the end of the 4th semester, each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ trainingcenter etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

INTERNET OF THINGS

Course code					
Category	Professional Core Course				
Course title	Internet of Things				
Scheme and Credits	L	T	P	Credits	Semester :IV
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES: The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-life IoT based projects.

UNIT I

Introduction to IoT: Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

UNIT II

Elements of IoT: Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/ Node.js/ Arduino) for Communication. Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

UNIT III

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

UNIT IV

IoT Case Studies : IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

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

1. Understand internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules.
3. Understand various IoT protocols.
4. Analyse data processing in IoT.
5. Remotely monitor data and control devices
6. Develop real life IoT based projects

1. Vijay Madisetti, Arshdeep Bahga, Ïnternet of Things, "A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
7. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media

DIGITAL & DATA COMMUNICATION

Course Code					
Category	**Professional Core Courses**				
Course title	**Digital & Data Communication**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : IV**
	3	**1**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. Understand the working principles of Data Communication.
2. Understand the Data link layer.
3. Understand the network security.

UNIT I

Data Transmission Basics: Communication model - Simplex, Half duplex, Full duplex transmission. Periodic analog signals - Sine wave, Amplitude, Phase, Wavelength, Time and frequency domain, Bandwidth. Analog & digital data and signals.Transmission impairments - Attenuation, Delay distortion, Noise. Data rate limits - Noiseless channel, Nyquist bandwidth, Noisy channel, Shannon's capacity formula.

UNIT II

Transmission Media: Guided transmission media - Twisted pair, Coaxial cable, Optical fiber. Unguided media - Radio waves, Terrestrial microwave, Satellite microwave, Infrared. Wireless propagation - Ground wave propagation, Sky wave propagation, Line-of-Sight (LoS) propagation.

Digital Transmission and Analog Transmission: Digital data to digital signal – Non-Return-to-Zero (NRZ), Return-to-Zero (RZ), Multilevel binary, Biphase. Analog data to digital signal - Sampling theorem, Pulse Code Modulation (PCM), Delta Modulation (DM).Digital data to analog signal - Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK). Analog data to analog signal - Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM).

UNIT III

Multiplexing and Spread Spectrum: Multiplexing - Frequency Division Multiplexing (FDM), Wavelength Division Multiplexing (WDM), Time Division Multiplexing (TDM), Characteristics, Synchronous TDM, Statistical TDM. Spread spectrum techniques - Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS), Code Division Multiplexing, Code Division Multiple Access (CDMA).

UNIT IV

Error Detection, Correction and Switching: Digital data communication techniques - Asynchronous transmission, Synchronous transmission. Detecting and correcting errors - Types of errors, Parity check, Checksum, Cyclic Redundancy Check (CRC), Forward Error Correction (FEC), Hamming distance, Hamming code. Basic principles of switching - Circuit switching, Packet switching, Message switching.

Course Outcomes

1. Identify the characteristics of signals for analog and digital transmissions
2. Identify the issues in data transmission .
3. Select transmission media based on characteristics and propagation modes
4. Choose appropriate signal encoding techniques for a given scenario
5. Illustrate multiplexing and spread spectrum technologies
6. Use error detection, correction and switching techniques in data communication

Text/Reference Books:

1. Forouzan B. A., Data Communications and Networking, 5/e, McGraw Hill, 2013.
2. William Stallings, Data and Computer Communication 9/e, Pearson Education, Inc. 273 COMPUTER SCIENCE AND ENGINEERING

References Books:

1. Schiller J., Mobile Communications, 2/e, Pearson Education, 2009.

ELECTRONIC MEASUREMENT AND INSTRUMENTATION

Course Code					
Category	**Professional Core Courses**				
Course title	**Electronic measurement and Instrumentation**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : IV**
	3	**1**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To introduce the fundamentals of Electronics Instruments and Measurement providing an in-depth understanding of Measurement errors.
2. Digital Storage Oscilloscope, Function Generator and Analyzer, Display devices, Data acquisition systems and transducers.
3. To address the underlying concepts and methods behind Electronics measurements.

UNIT I

OSCILLOSCOPE:Block diagram, study of various stages in brief, high frequency CRO considerations. Sampling and storage oscilloscope.

GENERATION & ANALYSIS OF WAVEFORMS:Block diagram of pulse generators, signal generators, function generators wave analysers,distortion analysers, spectrum analyser, Harmonic analyser, introduction to power analyser.

UNIT II

ELECTRONIC INSTRUMENTS:Instruments for measurement of voltage, current & other circuit parameters, Q meters, R.F. Power measurements, introduction to digital meters.

FREQUENCY & TIME MEASUREMENT:Study of decade counting Assembly(DCA), frequency measurements, period measurements, Universal counter, Introduction to digital meters.

UNIT III

DISPLAY DEVICES:Nixie tubes, LED's LCD's, discharge devices.

TRANSDUCERS:Classification, Transducers of types: RLC photocell, thermocouples etc. basic schemes of measurement of displacement, velocity, acceleration, strain, pressure, liquid level &temperature.

UNIT IV

INTRODUCTION TO SIGNAL CONDITIONING:

DC signal conditioning system, AC signal conditioning system, data acquisition andconversion system

Course Outcome:

1. Analyze the performance characteristics of each instrument
2. Illustrate basic meters such as voltmeters and ammeters.
3. Explain about different types of signal analyzers.
4. Explain the basic features of oscilloscope and different types of oscilloscopes
5. Identify the various parameters that are measurable in electronic instrumentation.
6. Employ appropriate instruments to measure given sets of parameters.

TEXT / REFERENCE BOOKS.

1. A course in Electrical & Electronics Measurements &Instrumentation : A.K.Sawhney; Dhanpat Rai Sons.
2. Electronics Instrumentation & Measurement Techniques : Cooper; PHI.

PROBABILITY THEORY AND STOCHASTIC PROCESSES

Code					
Category	**Basic Science Courses**				
Course title	**Probability Theory and Stochastic Processes**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : IV**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To introduce the fundamentals of probability theory and random processes and illustrate these concepts with engineering applications.
2. To introduce random variables.
3. The course introduces the concept of Stochastic Processes.
4. To understand regression analysis.

UNIT I

Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models. Discrete random variables, probability mass function, probability distribution function, example random variables and distributions;Continuous random variables, probability density function, probability distribution function, example distributions

UNIT II

Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds;

UNIT III

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.Random process.Stationary processes.Mean and covariance functions.Ergodicity.Transmission of random process through LTI.Power spectral density.

UNIT IV

Regression analysis (linear and non-linear) ,Confidence intervals, Hypothesis testing ,Error analysis

Course Outcomes:

1. Develop understanding of basics of probability theory.
2. Understand random variables.
3. Identify different distribution functions and their relevance.
4. Apply the concepts of probability theory to different problems.
5. Extract parameters of a stochastic process and use them for process characterization.
6. Apply regression analysis.

Text/Reference Books:

1. H. Stark and J. Woods, `Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
2. A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International 4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers, 5. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press

COMPUTER ORGANIZATION & ARCHITECTURE

Course Code					
Category	**Professional Core Courses**				
Course title	**Computer organization & architecture**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : IV**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. Discuss the basic concepts and structure of computers.
2. Understand concepts of register transfer logic and arithmetic operations.
3. Explain different types of addressing modes and memory organization.
4. Summarize the Instruction execution stages.

UNIT-I

Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uniprocessors to Multiprocessors. Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions, Logical operations, control operations. Case study - instruction sets of some common CPUs.
Fixed point Addition, Subtraction, Multiplication and Division.Floating Point arithmetic, High performance arithmetic, Subword parallelism.

UNIT-II

Introduction, Logic Design Conventions, Building a Datapath – A Simple Implementation scheme -An Overview of Pipelining – Pipelined Datapath and Control. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

UNIT-III

MEMORY AND I/O ORGANIZATION:
Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory. Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage, Input and Output Devices.

UNIT-IV

Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers – Introduction to Multiprocessor network topologies.

Course Outcomes: At the end of this course, students will demonstrate the ability to:

1. Understand basics of a computer system.
2. Understanding Logic gates, flip flops and counter
3. Clear Understanding of Computer Architecture
4. Pipeline processing
5. RISC and CISC architectures
6. Develop a base for advance micro-processors Reference

Text/ reference books:

1. Computer System Architecture: By M. Morris Mano.
2. Structured Computer Organization: By Tanenbaum.
3. Computer Organization: By Stallings.
4. Computer Architecture and Organization: By Hayes.
5. Microprocessor Architecture, Programming, and Applications with the 8085 Ramesh S. Gaonkar Pub: Penram International

MICROPROCESSORS AND INTERFACING

Course Code						
Category	**Professional Core Courses**					
Course title	**Microprocessors and Interfacing**					
Scheme	**L**	**T**	**P**	**Credits**	**Semester : IV**	
	3	**1**	**0**	**3**		
Class Work	30 Marks					
Exam	70 Marks					
Total	100 Marks					
Duration of Exam	03Hrs					

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course.

1. To develop an in-depth understanding of the operation of microprocessors.
2. To master the assembly language programming using concepts like assembler directives, procedures, macros, software interrupts etc.
3. To create an exposure to basic peripherals, its programming and interfacing techniques.
4. To understand the concept of Interrupts and interfacing details of 8086 .

UNIT-I

THE 8086 MICROPROCESSOR ARCHITECTURE: Architecture, block diagram of 8086, details of sub-blocks such as EU, BIU; memory segmentation and physical address computations, program relocation, addressing modes, instruction formats, pin diagram and description of various signals.

UNIT II

INSTRUCTION SET OF 8086: Instruction execution timing, assembler instruction format, data transfer instructions, arithmetic instructions, branch instructions, looping instructions, NOP and HLT instructions, flag manipulation instructions, logical instructions, shift and rotate instructions, directives and operators, programming examples.

UNIT III

Concepts of virtual memory, Cache memory, Architecture & Instructions set of X86 family Microprocessors (80186, 80286, 80386, 80486). Enhanced features of Pentium, Pentium Pro, Pentium-II, Pentium-III, Pentium-IV, Multi-core Technology, Mobile Processor.

UNIT IV

INTERFACING DEVICE: Serial I/O, parallel I/O, A/D & D/A converters.8255 Programmable peripheral interface, interfacing keyboard and seven segment display, 8254 (8253) programmable interval timer, 8259A programmable interrupt controller, Direct Memory Access and 8237 DMA controller.

Course Outcomes: At the end of this course students will be able to:

1. Understand the fundamentals of Microprocessors.
2. Understand the internal design of 8086 microprocessor along with the features .
3. Analyze a detailed s/w & h/w structure of the Microprocessor
4. Illustrate how the different peripherals (8086) are interfaced with Microprocessor.
5. Analyze the programming. of Microprocessors
6. Evaluate the data transfer information through serial & parallel ports.

Text / References Books:

1. Douglas Hall, "Microprocessor & Interfacing", 2nd Edition, TMH, 2006.
2. Muhammad A. Mazidi, "The 8051 Microcontroller And Embedded Systems Using Assembly and C", 2nd Edition., PHI, 2012.
3. Text / Reference Books: 1. D. V. Hall, Microprocessors and interfacing, Tata McGraw-Hill, 2nd Edition, 2006.
4. Ray A. K. and Burchandi, Advanced Microprocessors and Peripherals Architectures, Programming and Interfacing, Tata McGraw Hill, 2002.
5. Brey, The Intel Microprocessors 8086- Pentium Processor, 8th Edition, Pearson Education.
6. M. A. Mazidi, J. P. Maizidi and Danny Causey, The X86 PC: Assembly Language, Design and interfacing, 5th Edition, Pearson Education, 2017.
7. Liu Yu-Chang and Gibson Glenn A., Microcomputer Systems: The 8086/8088 Family: Architecture, Programming and Design, 2nd Edition, Pearson Education, 2015.
8. L. B. Das, The X86 Microprocessor (Architecture, Programming and Interfacing), 2nd Edition, Pearson Education, 2014.
9. Daniel Tabak, Advanced Microprocessor", Tata McGraw-Hill, 2nd Edition, 2012.
10. B. Ram, Fundamentals of Microprocessor and Microcomputers, Dhanpat Rai Publications, 5th edition, 2008.

11. MICROPROCESSOR & INTERFACING LAB

Course code						
Category	**Laboratory Courses**					
Course title	Microprocessor & Interfacing Lab					
Scheme and Credits	L	T	P	Credits	**Semester : IV**	
	0	0	2	2		
Classwork	50 Marks					
Exam	50 Marks					
Total	100 Marks					
Duration of Exam	02 Hours					

Note:

1. Total ten experiments are to be performed in the semester.
2. 2 At least seven experiments should be performed from the above list. Remaining three experiments
3. Should be performed as designed and set by the concerned institution as per the scope of the syllabus.

Course Objectives: The objectives of this course are as under:

1. To introduce the students with 8086 kit.
2. To acquaint them to do assembly language programming of 8086.
3. To acquaint them to do assembly language programming of 8086 for interfacing of peripherals.

LIST OF EXPERIMENTS:

1. To study the architecture of 8086 microprocessor and 8086 microprocessor kit.
2. Write a program to add the contents of the memory location to the content of other memory location and store the result in 3rd memory location.
3. Write a program to add 16 bit number using 8086 instruction set.
4. Write a multiplication of two 16 bit numbers using 8086 instruction set.
5. Write a program for division of two 16 bit numbers using 8086 instruction set.
6. Write a program factorial of a number.
7. Write a Program to transfer a block of data with & without overlap.
8. Write a program to find the average of two numbers.
9. Write a Program to check whether data byte is odd or even
10. Write a program to find maximum number in the array of 10 numbers.
11. Write a program to find the sum of the first ‘n’ integers.
12. Write a program to generate a square wave.
13. Write a program to generate a rectangular wave.
14. Write a program to generate a triangular wave.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Understand the fundamentals of Microprocessors.
2. Do assembly language programming of 8086.
3. Do assembly language programming of 8086 for interfacing of peripherals.
4. Can generate different kind of wave forms using assembly language.

ELECTRONIC MEASUREMENT & INSTRUMENTATION LABORATORY

Course Code						
Category	**Laboratory Courses**					
Course title	**Electronic Measurement& Instrumentation Laboratory**					
Scheme	**L**	**T**	**P**	**Credits**	**Semester : IV**	
	0	**0**	**2**	**1**		
Class Work	50 Marks					
Exam	50 Marks					
Total	100 Marks					
Duration of Exam	02Hrs					

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

(iii) Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS

1. Study blocks wise construction of a analog oscilloscope & Function generator.
2. Study blocks wise construction of a Multimeter & frequency counter.
3. Study Measurement of different components & parameters like Q of a coil etc using LCRQ meter.
4. Study of distortion factor meter and determination of the % distortion of the given oscillator
5. Determine output characteristics of a LVDT and Measure displacement using LVDT
6. Study characteristics of temperature transducer like Thermocouple, Thermistor & RTD with implementation of a small project using signal conditioning circuits like instrumentation amplifier.
7. Measurement of Strain using Strain Gauge.
8. To study differential pressure transducer & signal conditioning of output signal.
9. Measurement of level using capacitive transducer.
10. Study of Distance measurement using ultrasonic transducer.

Lab Outcomes: At the end of this lab, students will demonstrate the ability to;

1. Analyze the performance characteristics of each instrument
2. Illustrate basic meters such as voltmeters and ammeters.
3. Explain about different types of signal analyzers.
4. Explain the basic features of oscilloscope and different types of oscilloscopes
5. Identify the various parameters that are measurable in electronic instrumentation.
6. Employ appropriate instruments to measure given sets of parameters.

INTERNET OF THINGS LAB

Course Code					
Category	**Laboratory Courses**				
Course title	**Internet of Things LAB**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: IV**
	0	**0**	**2**	**1**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	02 Hrs				

Notes:
1. At least 10 experiments are to be performed by students in the semester.
2. At least 7 experiments should be performed from the list, remaining three experiments may either be Performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
3. Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS

1. To study the architecture and pins of Arduino
2. Write a program for blinking of LED and vary its intensity.
3. To sense the available networks using Arduino.
4. Measure the distance using ultrasonic sensor.
5. To detect the vibration of an object .
6. Sense the temperature and display it on LCD display.
7. Vary the intensity of light of LED using LDR.
8. MySQL Queries Database installation in Raspberry Pi
9. SQL Queries by Fetching data from Raspberry Pi.
10. Switch light ON and OFF based on the input of user using Raspberry Pi.

Lab Outcome: At the end of this lab, students will demonstrate the ability to;
1. Uunderstand the basics of IoT.
2. Learn Architecture and enabling technologies
3. Implement application of different sensors
4. Can design project using Arduino and Raspberry Pi

PCB & WORKSHOP LABORATORY

Course code					
Category	**Laboratory Courses**				
Course title	**PCB & WORKSHOP LAB**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester : IV**
	0	**0**	**2**	**2**	
Classwork	**50 Marks**				
Exam	**50 Marks**				
Total	**100 Marks**				
Duration of Exam	**02 Hours**				

Course Objective: To create interest in Hardware Technology.

1. Winding shop: Step down transformer winding of less than 5VA.

2. Soldering shop: Fabrication of DC regulated power supply

3. PCB Lab: (a) Artwork & printing of a simple PCB.

(b) Etching & drilling of PCB.

4. Wiring & fitting shop: Fitting of power supply along with a meter in cabinet.

5. Testing of regulated power supply fabricated.

Experiment to be performed

1. Introduction & Hands on experience to use circuit creation & simulation software like TINAPRO , MULTISIM, PSPICE or ORCAD etc.

2. Design a full wave centre tapped rectifier & study the effect of capacitive filter & its output on a virtual oscilloscope.

3. Design a RLC resonance circuit & verify the transient & phase response for different values of R,L &C.

4. Design a circuit for a fixed power supply.

5. Design a half adder using discrete components & verify the timing diagrams.

6. Convert the power supply circuit into PCB & simulates its 2D & 3D view.

7. PCB printing using screen printing or any other technique.

8. Etching of the above PCB.

9. UV exposure & Drilling of PCB.

10. Coating of etched PCB to protect it from oxidation.

11. Fabrication & placing of components as per above power supply circuit.

12. Testing of above circuit.

Course Outcomes: At the end of the course, students will be able to:

1. Understand the characteristics of diodes and filter circuits.

2. Understand the operation and characteristics of different types of rectifiers.

3. Understand the operation and characteristics of power supply.

SCIENTIFIC & TECHNICAL WRITING SKILLS

Course Code					
Category	**Mandatory Course**				
Course title	**Scientific & Technical writing Skills**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: IV**
	2	**0**	**0**	**0**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

The following course content to conduct the activities is prescribed for the Scientific & Technical writing Skills Lab:

1. Activities on Writing Skills - Structure and presentation of different types of writing - letter writing/ Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing - planning for writing - improving one's writing.
2. Activities on Presentation Skills - Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/ projects/ reports/ e-mails/ assignments etc.
3. Activities on Group Discussion and Interview Skills - Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews.

Text references:

1. A Course Book of Advanced Communication Skills (ACS) Lab published by Universities Press, Hyderabad.

Books Recommended:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. Technical Communication by Paul V. Anderson , 2007. Cengage Learning pvt. Ltd. New Delhi.
4. Business and Professional Communication: Keys for Workplace Excellence, Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications, 2011.
5. The Basics of Communication: A Relational Prespective, Stev Duck & David T. Mc Mahan. Sage South Asia Edition. Sage Publications, 2012.
6. English Vocabulary in Use series, Cambridge University Press 2008.
7. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
8. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley, 2012. Cengage Learning.
9. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
10. Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
11. Job Hunting by Colm Downes, Cambridge University Press 2008.
12. Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
13. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc graw Hill 2009.
14. Books on TOFEL/ GRE/ GMAT/ CAT/ IELTS by Barron's/ DELTA/ Cambridge University Press.
15. International English for Call Contres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

Gurugram University Scheme of Studies and Examination
Bachelor of Technology (Electronics & Communication Engineering)

SEMESTER V

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	PCC		Computer Networks	3	0	0	3	30	70	100
2	PCC		Digital System Design	3	0	0	3	30	70	100
3	PCC		Digital Signal Processing	3	0	0	3	30	70	100
4	PCC		Wireless & Satellite Communication	3	0	0	3	30	70	100
5	PEC		Program Elective - I	3	0	0	3	30	70	100
6	OEC		Open Elective - I	3	0	0	3	30	70	100
7	LC		Computer Networks Lab	0	0	2	1	50	50	100
8	LC		Digital Signal Processing Lab	0	0	2	1	50	50	100
10	LC		Digital System Design Lab	0	0	2	1	50	50	100
11	LC		Wireless & Satellite Communication lab	0	0	2	1	50	50	100
12	MC		Practical Training-I	0	0	2	-	30	70	100*
Total				28			22	380	620	1000

NOTE:

1. Choose any one from Professional Elective Course-I
2. Choose any one from Open Elective Course-I
3. ***Practical Training-I:**The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree.

PROFESSIONAL ELECTIVE- I (Semester-V)

Sr. No	Code	Subject	Credit
1.		Information Theory and Coding	3
2.		Antennas and Propagation	3
3.		Bio-Medical Electronics	3
4.		Introduction to MEMS	3
5.		Mobile applications development	3
6.		Analog Integrated Circuits	3

COMPUTER NETWORKS

Course Code					
Category	**Professional Core Courses**				
Course title	**Computer Network**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : V**
	3	**1**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To develop an understanding of modern network architectures from a design and Performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs), and Wireless LANs (WLANs).
3. To provide an opportunity to do Network programming.
4. To provide WLAN measurement ideas.

UNIT – I

Introduction: Data communication, Components, Data Representation, Simplex, Half Duplex, and Full Duplex Transmission, Modulation, Multiplexing, Computer networks, distributed processing, Internet, Topologies, Packet and circuit switching, connectionless and connection-oriented services.

Network Models: OSI model and TCP/IP Model

Physical Layer – LAN: Ethernet.

UNIT – II

Data Link Layer and Medium Access Sub Layer: MAC Addressing, Framing, Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window Protocol.

Medium Access Control: Random access, Controlled Access, and channelization protocols.

Network Layer: Logical addressing, classful and classless addressing, subnetting, Ipv4, ICMPv4, ARP, RARP and BOOTP, Ipv6, Ipv6 addressing.

UNIT – III

Network Devices: Repeater, hub, switch, router, and gateway.

Routing Algorithms: introduction to routing, Shortest Path Algorithm, Flooding, Hierarchical Routing, Link State, and Distance Vector Routing

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP connection management.

UNIT – IV

Congestion Control, Quality of Service, QoS Improving techniques.

Application Layer: Domain Name Space (DNS), EMAIL, File Transfer Protocol (FTP), HTTP, SNMP

Network Security: Firewalls, security goals, types of attack, symmetric and asymmetric key ciphers.

COURSE OUTCOMES: At the end of this course, students will demonstrate the ability to

1. Explain the functions of the different layers of the OSI Protocol.
2. Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs), and Wireless LANs (WLANs) and describe the function of each.
3. Identify and connect various connecting components of a computer network.
4. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, and Firewalls using open-source available software and tools.
5. outline various models, topologies and devices of Computer Networks.
6. Design engineering solutions to complex problems utilizing a systems approach.

TEXT AND REFERENCE BOOKS:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
3. Computer Networks, latest Edition, Andrew S. Tanenbaum, Pearson New International Edition.
4. Internetworking with TCP/IP, Volume 1, latest Edition Douglas Comer, Prentice Hall of India.
5. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

DIGITAL SYSTEM DESIGN

Course Code					
Category	**Professional Core Courses**				
Course title	**Digital System Design**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : V**
	3	**1**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To know the basic language features of Verilog HDL and the role of HDL in digital logic design.
2. To know the behavioural modeling of combinational and simple sequential circuits.
3. To know the behavioral modeling of algorithmic state machines.
4. To know the synthesis of combinational and sequential descriptions.
5. To know the architectural features of programmable logic devices.

UNIT I

Hardware modeling with the Verilog HDL: Encapsulation, modeling primitives, Types of Modelling. Logic system, Data types and operators.Behavioural descriptions in Verilog HDL.Styles for Synthesis of combinational logic and sequential logic. HDL based Synthesis – Technology Independent design

UNIT II

System Verilog standards, Key System Verilog enhancements for hardware design. Advantages of System Verilog over Verilog, Data Types: Verilog data types, System Verilog data types, 2 - State Data types, Bit, byte, shortint, int, longint. 4 - State data types. Logic, Enumerated data types, User Defined data types, Struct data types, Strings, Packages, Type Conversion: Dynamic casting, Static Casting, Memories: Arrays, Dynamic Arrays, Multidimensional Arrays, Packed Arrays, Associative Arrays, Queues, Array Methods, Tasks and Functions: Verilog Tasks and Functions

UNIT III

Verilog interface signals - Limitations of Verilog interface signals, SystemVerilog interfaces, SystemVerilog port connections, Interface instantiation. Interfaces Arguments, Interface Modports, Interface References, Tasks and functions in interface, Verilog Event Scheduler, SystemVerilog Event Scheduler, Clocking Block, Input and Output Skews, Typical Testbench Environment, Verification plan

UNIT IV

Random Variables - rand and randc, Randomize( ) Method - Pre/Post Randomize( ) methods, Constraints in the class, Rand mode and constraint mode, Constraint and Inheritance, Constraint Overriding, Set Membership, Distribution Constraints, Conditional Constraints - .implication (->), if/else, Inline Constraints

COURSE OUTCOMES: After successful completion of the course, the students are able to

1. Demonstate knowledge on HDL design flow,digital circuits design ,switch de-bouncing, metastability, memory devices applications
2. Can synthesis of combinational and sequential descriptions.
3. Design and develop the combinational and sequential circuits using behavioral modelling
4. Solving algorithmic state machines using hardware description language
5. Analyze the process of synthesizing the combinational and sequential descriptions
6. Memorizing the advantages of programmable logic devices and their description in Verilog

Reference Book

1. Samir Palnitkar "Verilog HDLA Guide to Digital Design Synthesis , " 2nd Edition, Pearson Education 2006.
2. Ashenden - Digital design,Elsevier
3. IEEE Standard VHDL Language Reference Manual latest edition
4. Digital Design and Modelling with VHDL and Synthesis : KC Chang; IEEE Computer Society Press.
5. "A VHDL Primmer" : Bhasker; Prentice Hall latest edition.
6. "Digital System Design using VHDL" : Charles. H.Roth ; PWS latest edition
7. "VHDL-Analysis & Modelling of Digital Systems" : Navabi Z; McGraw Hill.
8. VHDL-IV Edition: Perry; TMH latest edition
9. "Introduction to Digital Systems" : Ercegovac. Lang & Moreno; John Wiley latest edition
10. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH latest edition
11. Modern Digital Electronics- III Edition: R.P Jain; TMH latest edition.
12. Grout - Digital system Design using FPGA & CPLD 'S,Elsevier.

DIGITAL SIGNAL PROCESSING

Course Code					
Category	**Professional Core Courses**				
Course title	**Digital Signal Processing**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : V**
	3	**1**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To describe signals mathematically and understand how to perform mathematical operations on signals.
2. Get familiarized with various structures of IIR and FIR systems.
3. To discuss word length issues , multi rate signal processing and application.
4. Design and realize various digital filters for digital signal processing.

UNIT I

Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Z-Transform, Analysis of LSI systems, frequency Analysis, Inverse Systems,

UNIT II

Introduction to DFT: Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Use of FFT algorithms in Linear Filtering and correlation.

UNIT III

Structure of IIR: System Design of Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance. Bilinear transformation – Approximation derivatives – Design of IIR filter in the Frequency domain. : Symmetric & Anti-symmetric FIR filters: Linear phase filter – Windowing techniques – rectangular, triangular, Blackman and Kaiser windows – Frequency sampling techniques – Structure for FIR systems.

UNIT IV

Finite word length effects in FIR and IIR digital filters: Quantization, round off errors and overflow errors. Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators. Polyphase decompositions.Application of DSP – Model of Speech Wave Form – Vocoder.

COURSE OUTCOMES: After successful completion of the course, the students are able to

1. Interpret and analyze discrete time signals.
2. Compute Z transform.
3. Compute Discrete Fourier Transform.
4. Appreciate the importance of Fast Fourier Transform.
5. Design IIR and FIR filters.
6. Apply signal processing algorithms for real time applications.

Text Books

1. Digital Signal Processing A. Vallavaraj, C. Gnanapriya, and S. Salivahanan\
2. S.K. Mitra, Digital Signal Processing: A computer based approach.TMH
3. Oppenheim A V, Willsky A S and Young I T, "Signal & Systems", Prentice Hall, (1983).
4. Ifeachor and Jervis, "Digital Signal Processing", Pearson Education India.
5. DeFatta D J, Lucas J G and Hodgkiss W S, "Digital Signal Processing", J Wiley and Sons, Singapore, 1988

WIRELESS & SATELLITE COMMUNICATION

Course Code					
Category	**Professional Core Courses**				
Course title	**Wireless & Satellite Communication**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : V**
	3	**1**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To introduce the fundamentals of satellite communication .
2. To introduce roles of various sub-systems of a satellite system.
3. The course introduces the concept of Modulation and Multiple Access Schemes.
4. Study the satellite link design.
5. Study the satellite orbits.

UNIT I

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication. IRNSS-NAVIC: Navigation with Indian Constellation

Orbital Mechanics: Orbital equations, Kepler‟s laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal day.

UNIT II

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc

UNIT III

T**ypical Phenomena in Satellite Communication:** Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

Satellite link budget : Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

UNIT IV

Multiple Access Techniques For Wireless Communication: Introduction to Multiple Access, FDMA, TDMA, Spread Spectrum multiple Access, space division multiple access, packet ratio, capacity of a cellular systems.

Wireless Networking: Difference between wireless and fixed telephone networks, development of wireless networks, fixed network transmission hierarchy, traffic routing in wireless networks, wireless data services, common channel signaling, ISDN (Integrated Services digital Networks), advanced intelligent networks.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Understand the sub-systems of satellite communication systems and ground stations.
2. Understand the signal power calculation and issues in communication satellite tracking.
3. Compute parameters of orbital motions and understand communication with non-geosynchronous satellite
4. Understand different modulation types and interfacing the modems in satellite receivers.
5. Understand various multiple access technique.
6. Applications and frequency bands used for satellite communication.

Text /Reference Books:

1. Timothy Pratt and Jeremy Allnutt: “Satellite Communications”: Ed 3, 2021.Wiley India.
2. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill, 2001
3. Varsha Agrawal, Anil K. Maini, “Satellite Communications” Wiley India 2010.
4. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill.

DIGITAL SYSTEM DESIGN LABORATORY

Course Code					
Category	**Laboratory Courses**				
Course title	**Digital System Design Laboratory**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: V**
	0	**0**	**2**	**1**	
Class Work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	2Hrs				

Note:

1. At least 10 experiments are to be performed by students in the semester
2. At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
3. Group of students for practical should be 15 to 20 in number.

List of Experiments

Combinational & Sequential Design Exercises using HDL

1. Design a Half-Adder & Full Adder.
2. Design a Half Subtractor, & Full Subtractor
3. Design a parity generator
4. Design a 4 Bit comparator
5. Design a RS & JK Flip flop
6. Design a 4: 1 Multiplexer
7. Design a 4 Bit Up / Down Counter with Loadable Count
8. Design a 3: 8 decoder
9. Design a 8 bit shift register
10. Design a arithmetic unit

FPGA (Spartan 3) & CPLD

11. Implement ADC & DAC interface with FPGA
12. Implement a serial communication interface with FPGA
13. Implement a Telephone keypad interface with FPGA
14. Implement a VGA interface with FPGA
15. Implement a PS2 keypad interface with FPGA
16. Implement a 4-digit seven segment display

Lab outcomes:

1. Identify the various IC fabrication methods.
2. Express the Layout of simple MOS circuit using Lambda based design rules.
3. Apply the Lambda based design rules for subsystem design
4. Differentiate various FPGA architectures.
5. Design an application using Verilog HDL.
6. Concepts of modeling a digital system using Hardware Description Language.

DIGITAL SIGNAL PROCESSING LABORATORY

Course Code					
Category	**Laboratory Courses**				
Course title	**Digital Signal Processing Laboratory**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: V**
	0	**0**	**2**	**1**	
Class Work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	2Hrs				

Notes:

1. At least 10 experiments are to be performed by students in the semester.
2. At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
3. Group of students for practical should be 15 to 20 in number.

List of Experiments

11. Introduction to MATLAB.
12. Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)
2. To develop program for Z-Transform in MATLAB
3. To develop program for Convolution of sequences in MATLAB
4. To develop program for Correlation of sequences in MATLAB
5. To develop program for DFT & IDFT of two sequences
6. To develop program for FFT of two Sequences
7. To develop program for Circular Convolution
8. To design analog filter (low-pass, high pass, band-pass, band-stop).
9. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
10. To develop program for Interpolation and Decimation of sequences
11. To design FIR filters using windows technique.
12. Detection of Signals buried in Noise
13. Effect of noise on signals in MATLAB

Lab Outcomes:

At the end of this lab, students will be able to

1. Interpret and analyze discrete time signals.
2. Compute Z transform.
3. Compute Discrete Fourier Transform.
4. Appreciate the importance of Fast Fourier Transform.
5. Design IIR and FIR filters.
6. Apply signal processing algorithms for real time applications.

COMPUTER NETWORKS LAB

Course code					
Category	**Laboratory Courses**				
Course title	Computer Networks Lab				
Scheme and Credits	L	T	P	Credits	Semester IV
	0	0	2	2	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVES:

1. To understand the functionalities of various layers of OSI model.
2. Understand fundamental underlying principles of computer networking.

CONTENTS:

1. Study of Socket Programming and Client – Server model
2. Write a code simulating ARP /RARP protocols.
3. Write a code simulating PING and TRACEROUTE commands
4. Create a socket for HTTP for web page upload and download.
5. Write a program to implement RPC (Remote Procedure Call)
6. Implementation of Sub netting .
7. Applications using TCP Sockets like a. Echo client and echo server b. Chat c. File Transfer
8. Applications using TCP and UDP Sockets like. DNS e. SNMP f. File Transfer
9. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS
10. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer. i. Link State routing ii. Flooding iii. Distance vector
11. To learn handling and configuration of networking hardware like RJ, 45 connector, CAT,6 cable, crimping tool, etc.
12. Configuration of router, hub, switch etc. (using real devices or simulators)
13. Running and using services/commands like ping, traceroute, nslookuparp, telnet, ftp, etc.
14. Network packet analysis using tools like Wireshark, tcpdump, etc.

COURSE OUTCOMES: At the end of course , the student will be able to :

1. Develop Client , Server architectures and prototypes by the means of correct standards and technology
2. .Analyze data flow between peer to peer in an IP network using Application, Transport and Network Layer Protocols.
3. Analyse & Implement various framing methods of Data Link Layer.
4. Demonstrate basic configuration of switches and routers.
5. Analyse & Implement various Error and flow control techniques.
6. Implement network routing and addressing techniques.

WIRELESS & SATELLITE COMMUNICATION LABORATORY

Course Code					
Category	**Laboratory Courses**				
Course title	**Wireless & Satellite Communication Laboratory**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: V**
	0	**0**	**2**	**1**	
Class Work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	2Hrs				

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus. Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS:

1. To set up a satellite communication link & study of change in uplink & downlink frequency.
2. To Study Transmission of Audio & Video Signals & Data communication over satellite link.
3. To Study Transmission of telemetry data like temperature & light intensity over satellite link
4. To measure the propagation delay of signal in a Satellite communication Link.
5. To study different GPS data like longitude, latitude & different types of dilute of precision using GPS receiver..
6. To study selection of various PN codes like Gold, Barker & MLS in CDMA technology .
7. To study generation (spreading) & demodulation (Despreading) of of DSSS modulated signal
8. To study Voice communication over DSSS.
9. To study Minimum shift keying modulation & de modulation.
10. To study radiation pattern & calculate beam width for Yagi uda & Folded dipole antenna.
11. To study radiation pattern & calculate beam width for Circular & Triangular Patch Antenna.
12. to study FHSS Modulation & demodulation & transfer of numeric data.

Lab Outcomes: After completion of this course, students will be able to :

7. Describe the basic components of satellite communication system.
8. Understand transmission of audio & video signal, telemetry data, GPS data and modulation techniques.
9. Demonstrate radiation pattern and calculate beam width for different antennas.
10. Analyze the propagation delay of signals in satellite communication links.
11. Understand CDMA, spread spectrum techniques.

PRACTICAL TRAINING-I

Course Code					
Category	**PT**				
Course title	**Practical Training-I**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: V**
	2	**0**	**0**	**0**	
Class Work	30				
Exam	70				
Total	100				
Duration of Exam	3Hrs				

Note:The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree.

The students are required to undergo practical training of duration not less than 1.5 months in a reputed organization or concerned institute. The students who wish to undergo practical training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the midterm progress report at the institute. the presentation will be attended by a committee. alternately the teacher may visit the industry to get the feedback of the student.

The final Viva voice of the practical training will be conducted by an external examiner and one external examiner appointed by the institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the board of studies in engineering and technology. Assessment of industrial training will be based on seminar, viva-voice, report and certificate of practical training obtained by the student from the industry or institute.

PROFESSIONAL ELECTIVE – I

Information Theory and Coding

Course Code					
Category	**Professional Elective Courses**				
Course title	**Information Theory and Coding**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: V**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. Students study the basics of Information theory, techniques of coding and decoding.
2. Study to analyze and compare different coding and decoding schemes.
3. Solve numerical problems on channel capacity and coding.
4. Study broadcast channels for different coding schemes and also multiuser channel coding.

UNIT - I

Basics of information theory: Entropy for discrete ensembles; Shannon's noiseless coding theorem; Encoding of discrete sources. Markov sources, Shannon's noisy coding theorem and converse for discrete channels, Calculation of channel capacity and bounds for discrete channels, application to continuous channels.

UNIT - II

Techniques of coding and decoding: Channel Coding, Block and convolutional codes; majority logic decoding; Viterbi decoding algorithm, Coding gains and performance. Huffman codes and uniquely detectable codes; Cyclic codes, convolutional arithmetic codes.

UNIT - III

Network Information Theory: Overview of multiple access channel (MAC), Achievable result for MAC using successive decoding technique, Outer bound on the capacity region of MAC and its capacity analysis, Gaussian MAC and its capacity analysis.

Introduction to broadcast channel: Superposition coding scheme and its optimality for the degraded broadcast channel, Relation between the capacity region of Gaussian BC and MAC. Achievable rate for interference limited networks using conventional techniques such as time-sharing and treating interference as noise.

UNIT - IV

Introduction to channel coding for multi users: Introduction, Block codes for the binary adder channel, Trellis codes for the multiple access channel.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. To Study and Derive equations for entropy mutual information and channel capacity for all types of channels.
2. To acquire the knowledge about Fourier series and Fourier transform signal analysis tool.
3. Design a digital communication system by selecting an appropriate error correcting codes for a particular application.
4. To learn about Probability of Random signal theory and process.
5. Formulate the basic equations of linear block codes and a cyclic code.
6. Compare the performance of digital communication system by evaluating the probability of error for different error correcting codes.

Text/Reference Books:

1. N. Abramson, Information and Coding, McGraw Hill, 1963.
2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
3. R.B. Ash, Information Theory, Prentice Hall, 1970.
4. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
5. A. El Gamal and Y. H. Kim, Network Information Theory, Cambridge University Press, 2011

BIO-MEDICAL ELECTRONICS

Course Code					
Category	**Professional Elective Courses**				
Course title	**Bio-medical Electronics**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: V**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To understand concept of electronic systems design in Bio- medical applications.
2. To understand the biological process.
3. To understand non electrical parameter measurements.
4. To understand various Bio Medical Measuring Instruments and therapeuticequipments.

UNIT-I

Physiology and Transducers

Brief introduction to human physiology: Cell and its structure; Resting and Action Potential; Nervous system: Functional organisation of the nervous system; Structure of nervous system, neurons; synapse; transmitters and neural communication; Cardiovascular system; respiratory system; Basic components of a biomedical system. Biomedical transducers: Transducers selection criteria; Piezoelectric; ultrasonic; displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases; Temperature measurements; Fibre optic temperature sensors

UNIT-II

Electro – Physiological Measurements : Bio-electrodes and Biopotential amplifiers for ECG, EMG, EEG, etc.: Limb electrodes;floating electrodes; pregelled disposable electrodes; Micro, needle and surface electrodes;Preamplifiers, differential amplifiers, chopper amplifiers; Isolation amplifier. ECG; EEG;EMG; ERG; Lead systems and recording methods

UNIT-III

Non-Electrical Parameter Measurements

Measurement of blood temperature, pressure and flow; Cardiac output; Heart rate; Heartsound; Pulmonary function measurements; spirometer; Impedance plethysmography; Photo Plethysmography, Body Plethysmography

Unit-IV

Medical Imaging, Ultrasonic, X-ray and nuclear imaging: Radio graphic and fluoroscopic techniques; Computertomography; MRI; Ultrasonography, Assisting And Therapeutic Equipments, Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped; Safety aspects: safety parameters of biomedical equipments

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

1. Apply the concept of electronic systems design in Bio- medical applications.
2. Examine the practical limitations on the electronic components while handlingbio- substances.
3. Evaluate and analyze the biological processes like other electronic processes.
4. Measure non electrical parameter.
5. Familiar the various Bio Medical Measuring Instruments and the rapeutic equipments.
6. Aware of electrical safety of medical equipments

Text/ reference books:

1. W.F. Ganong, Review of Medical Physiology, latest edition, Medical Publishers
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, latest edition
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall,latest edition
4. R.S.Khander, Handbook of Biomedical Instrumentation‖, TATA Mc Graw-Hill,New Delhi, latest edition
5. Leslie Cromwell, ―Biomedical Instrumentation and Measurement, Prentice Hallof India, New Delhi, latest edition

ANTENNAS AND PROPAGATION

Course code					
Category	Professional Elective Courses				
Course title	Antennas and Propagation				
Scheme and Credits	L	T	P	Credits	Semester :V
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives: During the course, students will be made to learn to:

1. Understand the working principles of the Antenna.
2. Understand the types of Antenna and their propagation.
3. Understand limitations and application for different networks.

UNIT - I

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.
Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

UNIT-II

Aperture and Reflector Antennas- Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.
Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

UNIT – III

Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.
Antenna Arrays- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

UNIT - IV

Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, Fixed weight beamforming basics, Adaptive beamforming. Different modes of Radio Wave propagation used in current practice.

Course outcomes: At the end of this course students will demonstrate the ability to

1. Understands Physical concept of radiation, Radiation pattern
2. Understand antenna characteristics for different applications.
3. Analyze and design different types of antennas.
4. Understands basic concept of smart Antennas.
5. Design antenna arrays and understand operation of smart antennas.
6. Investigate different modes of propagation and their suitability for wireless communication

Text/Reference Books:

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook,cGraw ill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House,1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, TataMcGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

Analog Integrated Circuit

Course Code					
Category	**Professional Elective Courses**				
Course title	**Analog Integrated Circuit**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : V**
	3	**1**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:
1. To understand the functioning of OP-AMP and design OP-AMP based circuits
2. To design and analyze waveform Generators.
3. To design sinusoidal and non-sinusoidal oscillators
4. To understand the concept of filters and regulators.

UNIT I

IC OP-AMP applications: OP-AMP Fundamentals (brief review of differential amplifier, current mirror, active load, level shifter, output stage; ac and dc characteristics) Basic building blocks using OP-AMPS. Inverting/Non-inverting VCVS, Integrators, Differentiators, CCVS and VCCS, Instrumentation Amplifiers.

UNIT II

Waveform Generator: Square wave generators: 555Timer, Crystal controlled Oscillator Ramp Generator: Triangle generator, Sawtooth generator Sine wave generator: Requirement for sinusoidal oscillations, Wien-bridge and twin-T oscillators. Function Generators: Multi op-amp function generators, IC function generators Digitally controlled frequency synthesizer: PLL Fundamentals, PLL synthesizer, Totally digital synthesizer.

UNIT III

Active Filters: Introduction to filtering: Frequency response, Characteristics and terminology, Active versus passive filters Low pass filter: First order low pass active filter, second order active filter model, second order low pass filter characteristics, Sallen-Key unity gain filter, Sallen-Key equal component filter, Higher order filters. High pass active filter. Band pass filter: single op-amp band pass filter, multistage band pass filter State variable filter.

UNIT IV

Non-linear Circuits: Logarithmic Amplifiers, Log/Antilog Modules, Precision Rectifier, Peak Detector, Sample and Hold Circuits. OP-AMP as Comparator,Schmitt Trigger, Square and Triangular Wave Generator, Monostable Multivibrator. IC Analog Multiplier applications OTA
Voltage Regulators: OP-AMP Regulators, IC Regulators, Fixed Voltage Regulators (78/79, XX), SMPS.

Course Outcomes: At the end of this course, students will demonstrate the ability to:
1. Design, analysis, simulations, and testing of analog circuits,
2. Analog electronics, with focus on integrated circuit design
3. DC biasing, op-amp Cadence for Simulation Labs and Homework problems.
4. Understand filters and related terminology.
5. Concept of voltage regulators, SMPS
6.Different form of waves and how they generated.

Text Book:

1. Sedra and Smith, Microelectronic Circuits", Oxford University press, 5th Edition, 2005.
2. J. Michael Jacob, Applications and design with Analog Integrated Circuits", PHI, 2nd Edition, 2004.

Reference Book :

B.P. Singh and Rekha Singh, Electronic Devices an Integrated Circuits; Pearson Education, 1st Edition 2006.

MOBILE APPLICATIONS DEVELOPMENT

Course code					
Category	Professional Elective Courses				
Course title	Mobile applications development				
Scheme and Credits	L	T	P	Credits	Semester: V
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Introduce the students with the various "Next Generation Technologies" in the area of mobile computing
2. Assist students understand the various Mobile operating Systems
3. Explore the findings using Android Technologies

UNIT - I

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features

UNIT - II

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments , Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova.

UNIT - III

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization.

UNIT - IV

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment. iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development

methods, deployment

COURSE OUTCOMES: At the end of this course, students will demonstrate the ability to

1. Explain the principles and theories of mobile computing technologies.
2. Describe infrastructures and technologies of mobile computing technologies.
3. List applications in different domains that mobile computing offers to the public, employees, and businesses.
4. Describe the possible future of mobile computing technologies and applications.
5. Effectively communicate course work through written and oral presentations

TEXT AND REFERENCE BOOKS:

1. Anubhav Pradhan, Anil V Deshpande, " Mobile Apps Development" Edition:
2. Jeff McWherter, Scott Gowell "Professional Mobile Application Development", John Wiley & Sons, 2012.
3. Barry Burd, "Android Application Development All in one for Dummies", Edition: I
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS
5. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons
6. Henry Lee, Eugene Chuvyrov, "Beginning Windows Phone App Development", Apress, latest edition.
7. Jochen Schiller,"Mobile Communications", Addison-Wesley, latest edition
8. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028.

INTRODUCTION TO MEMS

Course code					
Category	Professional Elective Courses				
Course title	Introduction to MEMS				
Scheme and Credits	L	T	P	Credits	Semester :V
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES: The objectives of this course are as under:

1. To understand concept of Microystems and Microelectronics.
2. To understand the MEMS fabrication modules.
3. To understand Scaling effect,sensors.

UNIT - I

Introduction and Historical Background , Introduction Microsystems vs. MEMS, Microsystems and Microelectronics, the Multidisciplinary Nature of Microsystems design and manufacture, Application of MEMS in various industries. MEMS and Miniaturization: Scaling laws inminiaturization: Scaling Effects. Micro/ Nano Sensors, Actuators and Systems overview: Case studies.

UNIT - II

Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; BulkMicromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

UNIT - III

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods,

UNIT - IV

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems. Electrostatics, coupled electro mechanics.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Understand the multidisciplinary aspects of MEMS and NEMS.
2. MEMS and NEMS applications ,also learn sensors and actuators
2. Understand the methods of fabrication and modeling methods.
3. Appreciate the underlying working principles of MEMS and NEMS devices
4. Design and model these devices.
5. Understand mechanics of solid in MEMS and NEMS

Text/Reference Book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. . M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. . G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6 . M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and gyroscopes, Elsevier, New York, 2000.

Gurugram University Scheme of Studies and Examination

Bachelor of Technology (Electronics and Communication Engineering)

SEMESTER VI

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	PCC		Control System Engineering	3	0	0	3	30	70	100
2	PCC		Microwave & Radar Engineering	3	0	0	3	30	70	100
3	PEC		Program Elective - II	3	0	0	3	30	70	100
4	PEC		Program Elective - III	3	0	0	3	30	70	100
5	OEC		Open Elective - II	3	0	0	3	30	70	100
6	PCC		VLSI System Design	3	0	0	3	30	70	100
7	LC		Control System LAB	0	0	2	1	50	50	100
8	LC		Microwave & Radar Engineering Lab(P)	0	0	2	1	50	50	100
9	PROJ		Project-I	-	-	4	2	50	50	100
10	MC		Economics for Engineers	2	0	0	0	30	70	100*
Total				28			22	330	570	900

NOTE:

1. Economics for Engineers: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree.
2. At the end of the 6th semester, each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc. and submit the typed report along with a certificate from the organization and its evaluation shall be carried out in the 7th Semester.
3. Choose any one from each of the Professional Elective Course-II and III
4. Choose any one from Open Elective Course-II

PROFESSIONAL ELECTIVE- II (Semester-VI)

Sr. No	**Code**	**Subject**	**Credit**
1.		Robotics & Automation	3
2.		Wireless and Sensor Networks	3
3.		Mobile Communications	3
4.		Power Electronics	3

PROFESSIONAL ELECTIVE - III (Semester-VI)

Sr. No	Code	Subject	Credit
1.		Nano electronics	3
2.		High Speed Electronics	3
3.		Biosensors	3
4.		Image Processing	3

Control System Engineering

Course Code					
Category	**Professional Core Courses**				
Course title	**Control System Engineering**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : VI**
	3	**1**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To understand concepts of the mathematical modeling, feedback control and stability analysis in Time and Frequency domains
2. To develop skills, to analyze feedback control systems in continuous- and discrete time domains.
3. To learn methods for improving system response transient and steady state behavior (response).
4. The compensator design of linear systems is also introduced.

UNIT-I

Systems Components and Their RepresentationControl System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphsmodels-DC and AC servo Systems-Synchronous -Multivariable control system

UNIT-II

Time Response Analysis and Stability ConceptTransient response-steady state response-Measures of performance of the standard first orderand second order system-effect on an additional zero and an additional pole-steady errorconstant and system-type number-PID control.

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus.

UNIT-III

Frequency Domain AnalysisBode Plot - Polar Plot- Nyquist Plots-Design of compensators using Bode Plots-Cascade leadcompensation-Cascade lag compensation-Cascade lag-lead compensation

UNIT-IV

Control System Analysis Using State Variable MethodsState variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts ofControllability and Observability-Stability of linear systems-Equivalence between transferfunction and state variable representations

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Understand the concepts of control systems and importance of feedback in control systems.
2. Perform signal flow graph and formulate transfer function.
3. Perform computations and solve problems on frequency response analysis.
4. Analyse Polar, Bode and Nyquist's plot.
5. Evaluate different types of state models and time functions.
6. Analyse different types of control systems like linear and non-linear control systems, etc.

Text/Reference Books:

1. **B.S Manke , Linear Control system, Khanna Publication**
2. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997
3. Ambikapathy A., Control Systems, Khanna Book Publications, 2019.
4. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
5. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.
6. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi

MICROWAVE AND RADAR ENGINEERING

Course Code					
Category	**Professional Core Courses**				
Course title	**Microwave and Radar Engineering**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : VI**
	3	**1**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To build up the concept from basics of microwave communications to modern applications.
2. To analyze and study rectangular and circular wave guides using field theory.
3. To understand the theoretical principles underlying microwave devices and networks.
4. To design microwave components such as power dividers, hybrid junctions, Directional Couplers, microwave filters, Microwave Wave-guides and Components, Ferrite Devices.
5. To study about Microwave Solid-State Microwave Devices and Microwave Tubes. 5.
6. To Study about Microwave Measurement Techniques.

UNIT I

Transmission Line: Transmission line equations & solutions, reflection and transmission coefficient, standing wave, standing wave ratio, line impedance and admittance, Introduction to strip lines, Microstrip Transmission line (TL). Wave Guide: Rectangular Wave guide -Field Components and Parameters, TE, TM Modes, Dominant Mode, Circular Waveguides: TE, TM modes. Wave Velocities, Wave guide Cavities.

UNIT II

Passive microwave devices: Microwave Junctions and Couplers, Scattering Matrix, Passive microwave devices: Microwave Hybrid Circuits, Terminations, Attenuators, Phase Shifters, Microwave Propagation in ferrites, Faraday Rotation, Isolators, Circulators. S parameter analysis of all components.

UNIT III

Microwave tubes : Microwave Tubes: Limitation of Conventional Active Devices at Microwave frequency, Two Cavity Klystron, Reflex Klystron, Magnetron, Traveling Wave Tube, Backward Wave Oscillators: Their Schematic, Principle of Operation, Performance Characteristic and their applications. Microwave Measurements: Measurement of Insertion Loss, Frequency, Cavity Q, Dielectric Constant, Scattering Parameters, Noise Factors, Return Loss, Impendence; VSWR Metering and Measurement, High Power Measurement; Power Meters, Microwave Amplifiers.

UNIT IV

Introduction to RADAR systems: RADAR Block diagram, RADAR Range equation, Probability of detection of false alarm, Integration of RADAR pulses, RADAR cross UNIT I of targets, MTI RADAR, CW RADAR.

Course Outcomes:

1. Analyze various parameters and characteristics of the transmission line and waveguide and also use of wave guide component as per applications.
2. Describe, analyze and design simple microwave circuits and devices e g couplers, Attenuators, Phase Shifter and Isolators.
3. Student will also understand the microwave propagation in ferrites.
4. Analyze the difference between the conventional tubes and the microwave tubes for the transmission of the EM waves.
5. Acquire knowledge about the handling and measurement of microwave equipment.
6. Differentiate different Radars, find applications and use of its supporting systems.

Text Books:

1. Liao, S.Y., " Microwave Devices & Circuits", 3rd Edition, Prentice Hall of India Publication, 1995.
2. Sushrut Das, "Microwave Engineering", 1st Edition, Oxford University Publication, 2015.
3. M.I. Skolnik, "Introduction to Radar Engineering ", 3rd Edition, Tata McGraw Hill Publication, 2001.

Reference Books:

4.. A Das and S.K. Das, "Microwave Engineering", 1st Edition, Tata McGraw Hill Publication, 2000.

VLSI SYSTEM DESIGN

Course Code					
Category	**Professional Core Courses**				
Course title	**VLSI System Design**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : VI**
	3	**1**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To learn basic CMOS Circuits
2. To nurture students with CMOS analog circuit designs.
3. To realize importance of testability in logic circuit design.
4. To learn CMOS process technology.
5. To learn the concepts of designing VLSI Subsystems.

UNIT I

Introduction to MOSFETs : MOS Transistor Theory – Introduction MOS Device, Fabrication and Modeling , Body Effect, Noise Margin; Latch-up MOS Inverter :

UNIT II

MOS Transistors, MOS Transistor Switches, CMOS Logic, Circuit and System Representations, Design Equations, Static Load MOS Inverters, Transistor Sizing, Static and Switching Characteristics; MOS Capacitor; Resistivity of Various Layers. Symbolic and Physical Layout Systems – MOS Layers Stick/Layout Diagrams; Layout Design Rules, Issues of Scaling, Scaling factor for device parameters.

UNIT III

Combinational MOS Logic Circuits: Pass Transistors/Transmission Gates; Designing with transmission gates, Primitive Logic Gates; Complex Logic Circuits. Sequential MOS Logic Circuits: SR Latch, clocked Latch and flip flop circuits, CMOS D latch and edge triggered flip flop. Dynamic Logic Circuits; Basic principle, non ideal effects, domino CMOS Logic, high performance dynamic CMOSCircuits

UNIT IV

Clocking Issues, Two phase clocking. CMOS Subsystem Design: Semiconductor memories, memory chip organization, RAM Cells, dynamic memory cell.

Course outcomes: At the end of this course students will demonstrate the ability to

1. Understand MOS transistor theory and short channel effects.
2. Calculate Noise Margins & Propagation Delay of CMOS Inverter.
3. Analyze the combinational CMOS circuit for speed, power & area.
4. Implement combinational & sequential CMOS circuit with various topologies like domino logic.
5. Design of memories with efficient architectures to improve access times, power consumption.
6. Design an application using CMOS.

TEXT / REFERENCE BOOKS:

1. S. M. Kang and Y. Leblebici,CMOS Digital Integrated Circuits : Analysis andDesign, Third Edition, MH, 2002.
2. W. Wolf,Modern VLSI Design : System on Chip, Third Edition, PH/Pearson, 2002.
3. N. Weste, K. Eshraghian and M. J. S. Smith,Principles of CMOS VLSI Design : A Systems Perspective, Second Edition (Expanded), AW/Pearson, 2001.
4. J. M. Rabaey, A. P. Chandrakasan and B. Nikolic,Digital Integrated Circuits : A Design Perspective, Second Edition, PH/Pearson, 2003.
5. D. A. Pucknell and K. Eshraghian,Basic VLSI Design : Systems and Circuits, Third Edition, PHI, 1994.

CONTROL SYSTEM LABORATORY

Course Code					
Category	**Laboratory Courses**				
Course title	**Control System Laboratory**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VI**
	0	**0**	**2**	**1**	
Class Work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02Hrs				

Notes:

(iii) At least 10 experiments are to be performed by students in the semester.

(iv) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus. Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS: ANY SIX EXPERIEMENTS

1. To study speed Torque characteristics of
   a) A.C. servo motor
   b) DC servo motor.
2. (a) To demonstrate simple motor driven closed loop DC position control system.
   (b) To study and demonstrate simple closed loop speed control system.
3. To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots.
4. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing number of steps, direction of rotation & speed.
5. To implement a PID controller for temperature control of a pilot plant.
6. To study behavior of 1st order, 2nd order type 0, type 1 system.
7. To study control action of light control device.
8. To study water level control using a industrial PLC.
9. To study motion control of a conveyor belt using an industrial PLC

SOFTWARE BASED (ANY FOUR EXPT.)

Introduction to SOFTWARE (Control System Toolbox)

10. Different Toolboxes in SOFTWARE, Introduction to Control Systems Toolbox.
11. Determine transpose, inverse values of given matrix.
12. Plot the pole-zero configuration in s-plane for the given transfer function. Plot unitstep response of given transfer function and find peak overshoot, peak time.
13. Plot unit step response and to find rise time and delay time.
14. Plot locus of given transfer function, locate closed loop poles for different values ofk.
15. Plot root locus of given transfer function and to find out S, Wd, Wn at given root & todiscuss stability.
16. Plot bode plot of given transfer function and find gain and phase margins Plot the Nyquist plot for given transfer function and to discuss closed loop stability, gain and phase margin.

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands-on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/ disallowed.

Lab Outcomes: At the end of this lab students will demonstrate the ability to

1. Understand the concepts of control systems and importance of feedback in control systems.
2. Perform signal flow graph and formulate transfer function.
3. Perform computations and solve problems on frequency response analysis.
4. Analyse Polar, Bode and Nyquist's plot.
5. Evaluate different types of state models and time functions.
6. Analyse different types of control systems like linear and non-linear control systems, etc

MICROWAVE & RADAR ENGINEERING LABORATORY

Course Code					
Category	**Laboratory Courses**				
Course title	**Microwave & Radar Engineering Laboratory**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VI**
	0	**0**	**2**	**1**	
Class Work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02Hrs				

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus. Group of students for practical should be 15 to 20 in number.

COURSE OBJECTIVE:

1. Know about the behavior of microwave components.
2. Understand the radiation pattern of horn antenna.

LIST OF EXPERIMENTS:

1. To study wave guide components.
2. To study the characteristics of Gunn oscillator Gun diode as modulated source.
3. Study of wave guide horn and its radiation pattern and determination of the beam width.
4. To study isolation and coupling coefficient of a magic Tee.
5. To measure coupling coefficient, Insertion loss & Directivity of a Directional coupler.
6. To measure attenuation and insertion loss of a fixed and variable attenuator.
7. To measure isolation and insertion loss of a three port Circulators/Isolator.
8. To measure the standing wave ratio and reflection coefficient in a Microwave Transmission line.
9. To measure the frequency of a microwave source and demonstrate relationship among guide dimensions, free space wavelength and guide wavelength.
10. To measure the impedance of unknown load.
11. Use Doppler RADAR to detect the maximum range.
12. Determine the velocity of the moving objects with the help of RADAR range.
13. Use RADAR system to measure the distance traveled by any object.

Course Outcomes:

1. Demonstrate the characteristics of Microwave sources.
2. Demonstrate the characteristics of directional Couplers
3. To test the characteristics of microwave components
4. To analyze the radiation pattern of antenna
5. To measure antenna gain
6. Practice microwave measurement procedures

ECONOMICS FOR ENGINEERS

Course Code					
Category	**Mandatory Courses**				
Course title	**Economics for Engineers**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VI**
	2	**0**	**0**	**0**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree.

Course Objectives:

1. Acquaint the students to basic concepts of economics and their operational significance.
2. Acquaint students with market and its operation.
3. To stimulate the students to think systematically and objectively about contemporary economic problems.

UNIT-I

Definition of Economics- Various definitions, types of economics- Micro and Macro Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand- Meaning of Demand, Law of Demand, Elasticity of Demand- meaning, factors effecting it, its practical application and importance.

UNIT-II

Production- Meaning of Production and factors of production, Law of variable proportions, Returns to scale, Internal and external economies and diseconomies of scale.

Various concepts of cost of production- Fixed cost, Variable cost, Money cost,Real cost, accounting cost, Marginal cost, Opportunity cost. Shape of Average cost,Marginal cost, Total cost etc. in short run and long run.

UNIT-III

Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).

Supply- Supply and law of supply, Role of demand & supply in price determinationand effect of changes in demand and supply on prices.

UNIT-IV

Indian Economy- Nature and characteristics of Indian economy as underdeveloped, developing and mixed economy (brief and elementaryintroduction), Privatization - meaning, merits and demerits.Globalization of Indian economy - merits and demerits.Banking- Concept of a Bank, Commercial Bank- functions, CentralBank- functions, Difference between Commercial & Central Bank.

Course outcomes:

1. The students will able to understand the basic concept of economics.
2. The students will able to understand the basic concept of demand.
3. The student will able to understand the concept of production and cost.
4. The student will able to understand the concept of market.
5. The students will able to understand the basic concept of supply.
6. The student will able to understand the concept of privatization, globalization and banks.

References:

1. Jain T.R., Economics for Engineers, VK Publication.
2. Chopra P. N., Principle of Economics, Kalyani Publishers.
3. Dewett K. K., Modern economic theory, S. Chand.
4. H. L. Ahuja., Modern economic theory, S. Chand.
5. Dutt Rudar&Sundhram K. P. M., Indian Economy.
6. Mishra S. K., Modern Micro Economics, Pragati Publications.
7. Singh Jaswinder, Managerial Economics, dreamtech press.
8. A Text Book of Economic Theory Stonier and Hague (Longman's Landon).
9. Micro Economic Theory – M.L. Jhingan (S.Chand).
10. Micro Economic Theory - H.L. Ahuja (S.Chand).
11. Modern Micro Economics: S.K. Mishra (Pragati Publications).

PROJECT-I

Course Code					
Category	**Project**				
Course title	**Project-I**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VI**
	0	**0**	**2**	**1**	
Class Work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Course objectives:

1. To allow students to demonstrate skills learned during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation
2. To encourage research through the integration learned in a number of courses.
3. To allow students to develop problem solvingskills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report and to give an oral presentation and prepare a technical report.

The students are required to undertake institutional project work.

The final Viva voice of the institutional project work will be conducted by an external examiner and one external examiner appointed by the institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the board of studies in engineering and technology. Assessment of institutional project work will be based on seminar, viva-voice and report of institutional project work obtained by the student from the industry or institute.

The internal marks distribution for the students consists of 50 marks internally and 50 marks by an external examiner.

Course outcomes

On successful completion of the course students will be able to:

1. Demonstrate a sound technical knowledge of their selected project topic.
2. Undertake problem identification and formulation.
3. Design engineering formula to complex problems utilising a systems approach.
4. Researchand engineering project.
5. Communicate with engineers and the community at large in written and oral form.
6. Demonstrate the knowledge, skills and attitudes of a professional engineer.

PROFESSIONAL ELECTIVE-II

ROBOTICS & AUTOMATION

Course Code					
Category	**Professional Elective Courses**				
Course title	**Robotics & Automation**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VI**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all UNITs, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. To learn about relationship between mechanical structures of industrial robots.
2. To gain understanding of spatial transformation to obtain forward kinematic equation of robot manipulators.
3. To understand inverse kinematics of simple robot manipulators.
4. To learn about Jacobian matrix and use it to identify singularities.

UNIT-I

Introduction: Concept and scope of automation: Socio economic impacts of automation, Types of Automation, Low-Cost Automation

Fluid Power: Fluid power control elements, Standard graphical symbols, Fluid power generators, Hydraulic and pneumatic Cylinders - construction, design and mounting; Hydraulic and pneumatic Valves for pressure, flow and direction control.

UNIT-II

Basic hydraulic and pneumatic circuits: Direct and Indirect Control of Single/Double Acting Cylinders, designing of logic circuits for a given time displacement diagram & sequence of operations, Hydraulic & Pneumatic Circuits using Time Delay Valve & Quick Exhaust Valve, Memory Circuit & Speed Control of a Cylinder, Troubleshooting and "Causes & Effects of Malfunctions" Basics of Control Chain, Circuit Layouts, Designation of specific Elements in a Circuit.

Fluidics: Boolean algebra, Truth Tables, Logic Gates, Coanda effect.

UNIT-III

Electrical and Electronic Controls: Basics of Programmable logic controllers (PLC), Architecture & Components of PLC, Ladder Logic Diagrams

Transfer Devices and feeders: Classification, Constructional details and Applications of Transfer devices, Vibratory bowl feeders, Reciprocating tube, Centrifugal hopper feeders

UNIT-IV

Robotics: Introduction, Classification based on geometry, control and path movement, Robot Specifications, Robot Performance Parameters, Robot Programming, Machine Vision, Teach pendants, Industrial Applications of Robots

Course Outcomes (COs): After studying this course, students will be able:

1. To demonstrate knowledge of the relationship between mechanical structures of industrial robots and
2. To learn robot's operational workspace characteristics.
3. To demonstrate an ability to apply spatial transformation to obtain forward kinematic equation of robot manipulators.
5. To learn PLC
6. To demonstrate an ability to solve inverse kinematics of simple robot manipulators.
7. To demonstrate an ability to obtain the Jacobian matrix and use it to identify singularities.

Text Books:

1. Anthony Esposito, Fluid Power with applications, Pearson
2. S. R Majumdar, Pneumatic Control, McGraw Hill
3. S. R Deb, Robotic Technology and Flexible Automation, Tata Mc Hill
4. Saeed B. Niku Introduction to Robotics, Wiley India
5. Ashitava Ghosal, Robotics, Oxford

WIRELESS SENSOR NETWORKS

Course Code					
Category	**Professional Elective Courses**				
Course title	**Wireless sensor networks**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VI**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. Understand the working principles of the Sensors.
2. Understand the protocols used in sensor networks.
3. Understand design principles of WSN.
4. Understand engineering sensor networks.

UNIT-I

Introduction to Sensor Networks, unique constraints and challenges, Advantage of SensorNetworks, Applications of Sensor Networks, Types of wireless sensor networks, Mobile AdhocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for WirelessSensor Networks. Issues and challenges in wireless sensor networks.

UNIT-II

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, BMACprotocol, IEEE 802.15.4 standard and ZigBee

UNIT-III

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication

UNIT-IV

Single-node architecture, Hardware components & design constraints, Operating systems andexecution environments, introduction to TinyOS and nesC

Course Outcomes (COs): After studying this course, students will be able:

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Understand large sensor network.
5. Understand architecture and hardware components.
6. Explore new protocols for WSN

Text Books:

1. WaltenegusDargie , Christian Poellabauer, " Fundamentals Of Wireless Sensor Networks
2. Theory And Practice", By John Wiley & Sons Publications ,2011
3. SabrieSoloman, "Sensors Handbook" by McGraw Hill publication. 2009
4. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications,2004
5. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols andApplications, Wiley-Inter science
5. Philip Levis, And David Gay "TinyOS Programming" by Cambridge UniversityPress 2009

MOBILE COMMUNICATION

Course Code					
Category	**Professional Elective Courses**				
Course title	**Mobile Communication**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VI**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

During the course, students will be made to learn to:

1. Understand the Cellular concepts.
2. Understand the digital modulation techniques.
3. Understand the mobility in Cellular Systems.
4. Understand GSM.

UNIT-I

Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment,handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3Gcellular standards.

UNIT-II

Large scale signal propagation. Fading channels-Multipath and small-scale fading- Dopplershift, doppler spread, average and rms delay spread, coherence bandwidth and coherencetime, flat and frequency selective fading, slow and fast fading, average fade duration and
level crossing rate.
Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model,Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor),Partition losses between Floors, Log-distance path loss model.

UNIT-III

Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK,QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM and OFDMA.

UNIT-IV

Mobility in Cellular Systems: The Gateway Concept, Measurement Reports, MobilityProcedures - Mobile IP: Basic Components, Tunneling
GSM: Architecture, – UMTS: Architecture, Basics of CDMA, - Introduction to LTE: History,Architecture - OFDM – Uplink and Downlink Communication in LTE.

Course Outcomes (COs): After studying this course, students will be able:

1. To understand the working principles of the mobile communication systems.
2. To understand the relation between the user features and underlying technology.
3. To analyze mobile communication systems for improved performance.
4. To understand multiple access schemes.
5. To analyze mobility in cellular systems.
6. To discuss GSM.

Text Books:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley,1995.
5. VK Garg & JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall,1996.

POWER ELECTRONICS

Course Code					
Category	**Professional Elective Courses**				
Course title	**Power Electronics**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : VI**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To introduce power semiconductor devices, their switching principles and applications.
2. To explain the operation of AC-DC uncontrolled and controlled rectifier, DC-DC converters and DC-AC inverters.
3. To analyse the power electronic switch based rectifier, converters and inverters.
4. To introduce hardware tools for implementation of power electronic circuits.

UNIT I

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.Standard Driver Circuit Schematics for MoSFETs and IGBTs.

UNIT II

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

UNIT III

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter

UNIT IV

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.

Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Learn how to analyze inverters and some basic applications.
2. Analyze and design SMPS, controlled rectifiers DC to DC converters. and, DC to AC inverters.
3. Learn and design DC to AC inverters, Charge controllers
4. Analyze typical industrial application requirements and build a solution with commercially available power electronic devices
5. Analyse the operation of DC-DC choppers.
6. Analyse the operation of voltage source inverters

Text /Reference Books:

1) P.S. Bimbhra, Power Electronics, Khanna Book Publishing, 2022.
2) M Singh, K Khanchandani, "Power Electronics" McGraw Hill Education, 2nd Ed., 2017
3) Muhammad H. Rashid, "Power electronics" Prentice Hall of India.
4) Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.
5) P.C. Sen., "Modern Power Electronics", edition II, S.Chand & Co.
6) V.R.Moorthi, "Power Electronics", Oxford University Press.
7) Cyril W., Lander," Power Electronics", edition III,McGraw Hill.
8) G K Dubey,S R Doradla,:Thyristorised Power Controllers",New Age International Publishers. SCR manual from GE, USA.

PROFESSIONAL ELECTIVE-III

NANO ELECTRONICS

Course Code					
Category	**Professional Elective Courses**				
Course title	**Nano Electronics**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VI**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To understand various aspects of nano-technology and the processes involved inmaking nano components and material.
2. Toleverage advantages of the nano-materials and appropriate use in solvingpractical problems.
3. To understand various aspects of nano-technology.
4. To understand the processes involved inmaking nano components and material.

Unit-I

Introduction to nanotechnology, applications of nano electronics. Basics of QuantumMechanics: Wave nature of particles and wave-particle duality, Pauli Exclusion Principle,wave functions and Schrodinger's equations, Density of States, Band Theory of Solids,Particle in a box Concepts

Unit-II

Shrink-down approaches: CMOS scaling: advantages and limitations. Nanoscale MOSFETs,FINFETs, Vertical MOSFETs, system integration limits (interconnect issues etc.)

Unit-III

Nanostructure materials, classifications of nanostructure materials, zero dimensional, onedimensional, two dimensional and three dimensional, properties and applicationsCharacterization techniques for nanostructured materials: SEM, TEM and AFM

Unit-IV

Nano electronics devices: Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Singleelectron transistors, Carbon nanotube electronics, Band structure and transport, devices,applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

1. Understand various aspects of nano-technology.
2. Understand processes involved inmaking nano components and material.
3. Leverage advantages of the nano-materials and appropriate use in solvingpractical problems.
4. Understand various aspects of nano-technology and
5. Understand the processes involved inmaking nano components and material.
6. Analyse Nano Electronic devices.

Text/ reference books:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, latest edition
2. W. Ranier, Nanoelectronics and Information Technology (AdvancedElectronic Materialand Novel Devices), Wiley-VCH, latest edition
3. K.E. Drexler, Nanosystems, Wiley, latest edition
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, CambridgeUniversity Press, latest edition
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, latest edition

HIGH SPEED ELECTRONICS

Course Code					
Category	**Professional Elective Courses**				
Course title	**High Speed Electronics**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VI**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To Study the high-speed electronics system.
2. To Understand Radio frequency amplifiers.
3. To analyse mixers.
4. Learn the fabrication process.

Unit-I

Transmission line theory (basics) crosstalk and nonideal effects; signal integrity: impact ofpackages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery,methodologies for design of high-speed buses; radiated emissions and minimizing system noise.

Unit-II

Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Inter -modulation, Cross-modulation, Dynamic range.
Devices: Passive and active, Lumped passive devices (models), Active (models, low vs Highfrequency)

Unit-III

RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed)Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-overdistortion Efficiency RF power output stages.
Mixers –Up conversion Down conversion, Conversion gain and spurious response. OscillatorsPrinciples.PLL Transceiver architectures.

Unit-IV

Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, MicroviaBoards. Board Assembly: Surface Mount Technology, Through Hole Technology, ProcessControl and Design challenges.

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

1. Study the high-speed electronics system.
2. Understand significance and the areas of application of high-speed electronics circuits.
3. Understand the properties of various components used in high-speed electronics.
4. Understand Radio frequency amplifiers.
5. Analyse Mixers.
6. Design High-speed electronic system using appropriate components.

Text/ reference books:

1. Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: AHandbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press.
2. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits",CambridgeUniversity Press, 2004, ISBN 0521835399.
1. Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN 0-13-887571-5.
2. Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall.
3. Kai Chang, "RF and Microwave Wireless systems", Wiley.
4. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

BIOSENSORS

Course Code					
Category	**Professional Elective Courses**				
Course title	**Biosensors**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VI**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To understand the basic principles and classification of sensors and measurands.
2. To know the hardware and software of DAQ system and Electronic Interface systems
3. To understand how to measure various parameters and helps to design simple biomedical sensors.
4. To study about the sensor measurements for biological applications.

UNIT-I

Overview of biosensors and their electrochemistry: Molecular reorganization: Enzymes, Antibodiesand DNA, Modification of bio recognition molecules for Selectivity and sensitivity, Fundamentals ofsurfaces and interfaces

UNIT-II

Bioinstrumentation and bioelectronics devices: Principles of potentiometry and potentiometricbiosensors, Principles of amperometry and amperometric biosensors, Optical Biosensors based onFiber optics, Introduction to Chemometrics, Biosensor arrays; Electronic nose and electronic tongue.

UNIT-III

Iron-Selective Field-Effect Transistor (ISFET), Immunologically Sensitive Field Effect Transistor(IMFET). Fabrication and miniaturization techniques.

UNIT-IV

Sensor-to-Frequency Conversion Data-Acquisition Systems: Hardware and Software of DataAcquisition System (DAS), Electronic Interface, Integrated Sensors, Wireless integration. Smartsensor, Nano sensor.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the basic principles and classification of sensors and measurands.
2. Understand the hardware and software of DAQ system and Electronic Interface systems.
3. Understand how to measure various parameters and helps to design simple biomedical sensors.
4. Explain the concept of molecular reorganization, fundamentals of surfaces and interfaces.
5. Elucidate the principles of different types of biosensors
6. Understand sensor measurements for biological applications.

Text Books

1. Gardner, J.W., Microsensors, Principles and Applications, John Wiley and Sons(1994).
2. Kovacs, G.T.A., Micromachined Transducer Sourcebook, McGrawHill (2001).
3. Turner, A.P.F., Karube,I., and Wilson G.S., BiosensorsFundamentals and Applications, OxfordUniversity Press (2008)
4. Jon Cooper, Biosensors A Practical Approach, Bellwether Books
5. Manoj Kumar Ram, Venkat R, Bhethanabolta, Sensors for chemical and biological applications,CRC Press

IMAGE PROCESSING

Course Code					
Category	**Professional Elective Courses**				
Course title	**Image Processing**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VI**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To understand need for image transforms different types of image transforms and their properties.
2. Analyse image processing application and Machine vision.
3. Implementing image compression and spatial and frequency domain techniques of image compression.
4. To understand different feature extraction techniques.

UNIT-I

INTRODUCTION: Image Processing Fourier Transform and Z-Transform Causality and stability Toeplit and Circulate Metrics orthogonal and unitary Matrices and Kronecker product, Markov Processes KI Transform Mean square Estimates and Orthogonal Principles.

IMAGE SAMPLING QUANTIZATION: Band Limited Image Sampling Versus Replication, Reconstruction ofImage from samples Sampling Theorem, Sampling Theorem for Random Fields, Optimal Sampling, Nonrectangular Grid Sampling, Sampling Aperture, Display Aperture/ Interpolation Functions, Lagrange Interpolation Moire Effect. Image Quantization Uniform Optimal Quantizer, Properties of Mean Square Quantizer, Commander Design Visual Quantization

UNIT-II

IMAGE TRANSFORMS: Two Dimensional Orthogonal and Unitary Transforms and their properties. One-dimensional and Two Dimensional DFT Cosine and Sine Transforms.Hadamard, Slant, Harr and KL,Transforms and their properties, Approximation to KI Transforms.

IMAGE REPRESENTATION BY STOCHASTIC MODELS: One Dimensional Causal Models, AR and ARMA models, Non Causal Representation Spectral factorization, Image Decomposition.

UNIT-III

IMAGE ENHANCEMENT AND RESTORATION: Point Operation, Histogram Modeling, Spatial Operations, Transform Operations, Multispectral Image Enhancement. Image Observation Models, Inverse and Wiener filtering; FIR Wiener Filters, Filtering using Image Transform Causal Models and recursive filtering Maximum entropy restoration. Extrapolation of band limited signal.

UNIT-IV

IMAGE ANALYSIS AND IMAGE COMPRESSION: Spatial feature extraction, Edge detection and boundary extraction Boundary, region and moment representations structures, Texture, Image Segmentation, Reconstruction from Projections, Pixel Coding, Productive Techniques, Transform Coding Theory, Coding of Image, Coding of two-tone image.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Understand the need for image transforms different types of image transforms and their properties.
2. Develop any image processing application and understand the rapid advances in Machine vision.
3. Learn different techniques employed for the enhancement of images.
4. Learn different causes for image degradation and overview of image restoration techniques.
5. Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.
6. Learn different feature extraction techniques for image analysis and recognition.

Text Books:

1. Anil Jain, Digital Image Processing, PHI.
2. Gonzalez and Woods, Image Processing, Addison Wesley & Sons.
3. Digital Image Enhancement, Restoration and Compression, 4th Edition, SE Umbaugh, Taylor & Francis/CRC Press, 2023
4. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication",1st edition, PHI

Gurugram University Scheme of Studies and Examination
Bachelor of Technology (Electronics & Communication Engineering)

SEMESTER VII

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	PCC		Microcontroller & Embedded System	3	0	0	3	30	70	100
3	PEC		Program Elective-IV	3	0	0	3	30	70	100
4	OEC		Open Elective –III	3	0	0	3	30	70	100
5	OEC		Open Elective -IV	3	0	0	3	30	70	100
6	LC		Microcontroller & Embedded System Lab	0	0	2	1	50	50	100
7	HUM		Organizational Behaviors	3	0	0	3	30	70	100
8	PROJ		Project-II	0	0	6	3	100	100	200
9	PROJ		Practical Training-II	-	-	2	2	100	-	100
Total				25			21	400	500	900

NOTE:

1. Choose any one from Professional Elective Course-IV
2. Choose any one from each of the Open Elective Course-III and IV

PROFESSIONAL ELECTIVE- IV (Semester-VII)

Sr. No	Code	Subject	Credit
1.		Optical Fibre Communication	3
2.		Neural Networks & fuzzy logic	3
3.		Telecommunication and Switching Networks	3
4.		Data Communication Networking & Security	3
5.		Radar and Sonar	3
6		Error Correcting Codes	3
7		Digital Audio Processing	3

MICROCONTROLLER & EMBEDDED SYSTEMS

Course Code					
Category	**Professional Core Courses**				
Course title	Microcontroller & Embedded System				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective:

1. To introduce students to the microcontroller and embedded system and applications. .
2. To make understand the architecture of PIC and 8051 microcontrollers in detail.
3. To provide knowledge about the embedded system and interfacing.

UNIT I

Introduction to Embedded Systems: Definition, Processor embedded into a system, embedded hardware units and devices into a system, embedded software in a system, examples of Embedded systems, Embedded SOC and Use of VLSI Circuit Design Technology, Complex Systems Design and Processes, Design Process in Embedded System, Formalization of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skills Required for an Embedded System Design.

UNIT II

Difference between Microprocessor and Microcontroller.
8051 Microcontroller: Architecture: CPU Block diagram, Memory Organization, Program memory, Data Memory, Interrupts.
Peripherals: Timers, Serial Port, I/O Port Programming: Addressing Modes, Instruction Set, Programming.
Microcontroller based System Design: Introduction, A microcontroller specification, microcontroller design, testing the design, timing subroutines and lookup tables. Interfacing of LCD and A/D to 8051.

UNIT III

Real World Interfacing, Introduction to Advanced Architectures: 80x86, ARM7, SHARC, DSP
Processor and Memory Organization, Instruction Level Parallelism, Performance Metrics, Memory Types, Memory Maps and addresses, Processor and Memory Selection,
Device and Communication Buses for Device Network: I/O type examples, serial Communication Devices, Parallel Device Ports, Wireless Devices, Timer and Counting Devices, watchdog Timer, Real Time Clock, Networked Embedded Systems, Internet Enabled Systems.

UNIT IV

Real Time Operating Systems
OS Services, Process Management, Timer Functions, Event Functions, Memory Management, Device File and IO Subsystem Management, Interrupt Routines in RTOS Environment and Handling Interrupt Source Cells, Real-Time operating Systems, Basic Design using an RTOS, RTOS task Scheduling Models, Interrupt latency and Response of the Tasks as performance Metrics, OS Security Issues, Case study of Digital camera Hardware and Software Architecture.

COURSE OUTCOMES: After the completion of the course the student will be able to:

1. To gain the knowledge about Microcontroller and its need.
2. To learn and understand the basic architecture of different Microcontroller 8051.
3. Foster ability to write the programming using 8051 microcontrollers.
4. To learn and understand the internal architecture and interfacing of different peripheral devices.
5. Ability to understand the role of Embedded systems in the industry.
6. To understand the design concept of Embedded systems.

TEXT / REFERENCE BOOKS:

1. B. B. Brey: The Intel Microprocessors, Architecture, Programming and Interfacing, Pearson Education.
2. Design with PIC Microcontrollers by John B. Peatman , Pearson.
3. Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.
4. V. Udayashankara and M. S. Mallik arjunaswamy: 8051 Microcontroller, TMH, New Delhi
5. Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education.
6. A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
7. D. V. Hall: Microprocessors and Interfacing, TMH
8. Programming and Customizing the 8051 Microcontroller : Predko ; TMH.
9. Programming Embedded Systems in C and C++ : Michael Barr; SHROFF PUB. & DISTR

MICROCONTROLLER & EMBEDDED SYSTEM LAB

Course Code					
Category	**Laboratory Courses**				
Course title	Microcontroller & Embedded System Lab				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	3	**0**	**0**	**3**	
Class Work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02Hrs				

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

COURSE OBJECTIVES:

1. To impart the basic concepts of microcontroller programming and Architecture.
2. To program and interface PD with microcontroller.

LIST OF EXPERIMENTS:

1. To study development tools/environment for ATMEL/PIC microcontroller programme and Architecture.
2. Write an assembly language program to add, subtract, multiply, divide 16 bit data by Atmel microcontroller.
3. An assembly language program to generate 10 KHz frequency using interrupts on P1.2.
4. Study and analyze the interfacing of 16 x 2 LCD.
5. Study of implementation, analysis and interfacing of seven segment display.
6. Study of implementation of steeper motor angle control.
7. Study of implementation of DC Motor control using PWM method.
8. Study and observation of Position control of Servo Motor.
9. Study of Programming and Transmission and Reception of data through serial port.
10. To study implementation and programming of Pressure measurement.
11. To study implementation and programming of Temperature measurement.
12. Study and analysis of interfacing of graphical LCD using PIC Microcontroller.
13. To interface PWM based voltage regulator using PIC Microcontroller.
14. Study and interface of IR (RC5 Protocol) and RF Communication using PIC Microcontroller.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Do assembly language programming of a Microcontroller .
2. Do assembly language programming of microcontroller for interfacing of peripherals.

ORGANIZATIONAL BEHAVIOUR

Course Code					
Category	**Humanities & Management course**				
Course title	**Organizational Behaviour**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. The objective of Organizational Behaviour (OB) is to study human behaviour withinan organizational context.
2. The objective of Organizational Behaviour (OB) is to understand human behaviour withinan organizational context.
3. The course aims to provide students with knowledge and skills to analyze and explainindividual and group behaviour in organizations.
4. The course aims to provide students with knowledge and skills to influenceindividual and group behaviour in organizations.

UNIT-I

Introduction of Management: Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management &Importance of management. Difference between management and administration.

UNIT-II

Introduction of organization: Meaning and process of Organization, Management v/s organization; Fundamentals of Organizational Behaviour: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB. Individual Processes and Behaviour, Personality, Concept, determinants and applications; Perception, Concept, process and applications, Learning, Concept (Brief Introduction);Motivation, Concept, techniques and importance

UNIT-III

Interpersonal Processes, Teams and Groups, Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team andgroup, Conflict, Concept, sources, types, management of conflict; Leadership: Concept, function, styles & qualities of leadership. Communication – Meaning, process, channels of communication, importance and barriers of communication.

UNIT -IV

Organizational Processes: Organizational structure, Meaning and types of organizational structure and their effect on human behaviour; Organizational culture, Elements, types and factors affecting organizational culture. Organizational change: Concept, types & factors
affecting organizational change, Resistance to Change.

Course Outcomes: At the end of this course,

1. Students will be able to apply the managerial concepts in practical life.
2. Students will be able to understand the functions of management.
3. The students will be able to understand the concept of organizational behaviour at individual level and interpersonal level.
4. Students will be able to understand the behavioural dynamics in organizations.
5. Students will be able to understand the leadership.
6. Students will be able to understand the organizational culture and change

Text / References

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, OrganisationalBehaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding OrganisationalBehaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., OrganisationalBehaviour, Prentice Hall of India, NewDelhi.
1. GhumanKarminder, Aswathappa K., Management concept practice and cases, Mc Graw Hilleducation.
2. Chhabra T. N., Fundamental of Management, Sun India Publications,New Delhi

PRACTICAL TRAINING-II

Course Code					
Category	**Project**				
Course title	**Practical Training-II**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	0	**0**	**2**	**2**	
Class Work	100 Marks				
Exam					
Total	100 Marks				
Duration of Exam					

The students are required to undergo practical training of duration not less than 1.5 months in a reputed organization or concerned institute. The students who wish to undergo practical training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the midterm progress report at the institute. the presentation will be attended by a committee. alternately the teacher may visit the industry to get the feedback of the student.

The final Viva voice of the practical training will be conducted by an external examiner and one external examiner appointed by the institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the board of studies in engineering and technology. Assessment of industrial training will be based on seminar, viva-voice, report and certificate of practical training or institutional project work obtained by the student from the industry or institute.

The internal marks distribution for the students who have undergone industrial training consist of 100 marks internally.

PROJECT-II

Course Code					
Category	**Project**				
Course title	**Project-II**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	0	**0**	**3**	**2**	
Class Work	100 Marks				
Exam	100 Marks				
Total	200 Marks				
Duration of Exam	3Hrs				

Course objectives:

1. To allow students to demonstrate a wide range of the skills by workingon PROJECT-I that has passed through the design, analysis, testing and evaluation
2. To encourage problem solving skills.
3. To allow students to develop problem solving, synthesis and evaluation skills.
4. To encourage teamwork and leadership.
5. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation.

The students are required to undertake institutional project work.

The final Viva voice of the institutional project work will be conducted by an external examiner and one external examiner appointed by the institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the board of studies in engineering and technology. Assessment of institutional project work will be based on seminar, viva-voice and report of institutional project work obtained by the student from the industry or institute.

The internal marks distribution for the students consists of 100 marks internally and 100 marks by an external examiner.

Course outcomes

On successful completion of the course students will be able to:

1. Demonstrate a sound technical knowledge of their selected projectsolution.
2. Undertake problem solution.
3. Design engineering solutions to complex problems utilising a systems approach.
4. Conduct the remaining engineering project.
5. Communicate with team members at large in written an oral form.
6. Demonstrate the knowledge, skills and attitudes of a professional engineer.

PROFESSIONAL ELECTIVE- IV (Semester-VII)

FIBER OPTIC COMMUNICATION

Course Code					
Category	**Professional Elective Courses**				
Course title	Fiber Optic Communication				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
2. To learn the various optical sources, materials and fiber splicing
3. To learn the fiber optical receivers and noise performance in photo detector, link budget, WDM.

UNIT I

Optical fiber communication Introduction ,general system, advantages, disadvantages, and applications . Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

UNIT II

Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

UNIT III

Optical sources - LEDs and Lasers, Photo-detectors - pin-detectors, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

Optical switches - coupled mode analysis of directional couplers, electro-optic switches.

UNIT IV

Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solition based communication. Optical amplifiers - EDFA, Raman amplifier, Coherent communication and WDM systems.

Course outcomes: At the end of this course students will demonstrate the ability to

1. Understand different models of light and their limitations.
2. Understand propagation of light in different types of optical fibers and signal degradation.
3. Design analog and digital optical communication links and analyze their performance.
4. Understand, analyze and design high-capacity advanced optical communication systems.
5. Learn different types of amplifier used in optical fiber communication.
6. Learn the fiber optical network components.

Text/Reference Books :

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 2nd Ed. 1992.
2. John M Senior," Optical Fiber Communications Principles and Practice", Pearson 3rd Edition
3. J.E. Midwinter, Optical fibers for transmission, John Wiley, 1979.
4. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
5. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1992

NEURAL NETWORKS & FUZZY LOGIC

Course Code					
Category	**Professional Elective Courses**				
Course title	**Neural Networks & Fuzzy logic**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. To learn various soft computing techniques
2. To gain understanding of Fuzzy logic and ANN.
3. To gain understanding of ANN based controller design.
4. To understand Evolutionary algorithm and hybrid system.

UNIT-I

Soft Computing: Introduction, requirement, different soft computing techniques and theircharacteristics, comparison with hard computing, applications.

UNIT-II

Fuzzy sets and Fuzzy logic: Introduction, Fuzzy sets versus crisp sets, properties of fuzzysets, operations on fuzzy sets, Extension principle, Fuzzy relations, Linguistic variables,linguistic terms, Linguistic hedges, Fuzzy reasoning, Mamdani and TSK fuzzy inferencesystems, Applications, fuzzy controllers, Theoretical and implementation issues.

UNIT-III

Artificial Neural Network: Introduction, comparison with biological neural network, basicmodels of artificial neuron, different architectures of ANN, learning techniques, ANN basedsystem modelling, ANN based controller design, theoretical and implementation issues,Applications.

UNIT -IV

Evolutionary algorithms and hybrid systems: Genetic Algorithm (GA), different operators ofGA, convergence of Genetic Algorithm, Particle swarm optimization algorithm, Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm forNeural Network Design, Fuzzy Logic design, other Applications of GA.

Course Outcomes: At the end of this course, students will demonstrate the ability

1. To understand the concepts of soft computing vis-à-vis hard computing
2. To understand ANN.
3. To introduce the ideas of fuzzy logic, neural networks, genetic algorithm.
4. To introduce the concepts of evolutionary algorithms.
5. To introduce the concepts of hybrid intelligent systems.
6. To introduce application areas of soft computing and the criteria to select appropriate softComputing

Text / References Books:

1. Neuro Fuzzy & Soft Computing - J.-S.R.Jang, C.-T.Sun, E.mizutani, Pearson Education
2. Neural Networks and Fuzzy Systems: Dynamical Systems Application to Machine Intelligence -Bart Kosko, Prentice Hall
3. T.J. Ross, "Fuzzy Logic Control", TMH Publications.
4. S. Hekins, "Comprehensive Neural Networks", Pearson Publications.
5. S. Rajsekharan, Vijayalaxmi Pai, "Neural Networks, Fuzzy logic and Genetic Algorithms,Synthesis and applications", Prentice Hall
7. V. Kecman, "Learning and Soft Computing", MIT Press. B.Tech. (Electrical Engineering) BOS 24-05-2017
8. D. Ruan, "Intelligent Hybrid Systems", Kluwer Academic Publisher.

Telecommunication and Switching Networks

Course Code					
Category	**Professional Elective Courses**				
Course title	**Telecommunication and Switching Networks**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. Different components of telecommunication are explained.
2. Telecommunication traffic is measured by considering the mathematical model for network traffic.
3. Different signaling systems are explained.

UNIT I

Introduction: Evolution of Telecommunication, Switching System, Classification of Switching, Types of Telephone Switching Systems, Elements of Telecommunication, Telecommunication Standard. Telephone System: PSTN, Modern Telecom System, Telephone Network, Telephone Set, Telephone Network organization, Principles and examples of step by step, Cross bar and reed relay systems, Telephone numbering plan, Central Battery System, Transmission impairments, Two-four-wire transmission, Subscriber
Loop Design.

UNIT II

Telecommunication traffic: Telecommunication traffic, Traffic considerations, Erlang, Grade of Service, Traffic Measurement, Mathematical model for telecommunication traffic. Switching System: Resource sharing and need for switching, Need for Networks, Switching, Types of Switching, Circuit Switching, Message Packet Switching, Store & Forward Switching, Function of Switching System, Electronic Switching System, Multiplexing, IDM (E1/E2. TI), FDM, Implementation of Switching System, Blocking and Non-blocking Switches, Single & Multi stage Switches, Space Switching, Time Switching, Hybrid
Switching, Path finding, Complexity, Blocking Probability of Switch.

UNIT III

Telephone Exchange: Stored Program Controlled Exchange, Electronic Exchange, Electronic Switching & Stored Program Control Systems, Digital Switching Time, Space & Hybrid Switches, Example of Digital Exchanges, Example of Modern Exchanges (C-DOI exchange), Availability of Parallel Exchange.

UNIT IV

Signaling Systems: Signaling, Types of Signaling information, Forms of Signaling, Channel Associated Signaling (CAS), Common Channel Signaling, CCITT No-7 System, SS7 Signaling, Architecture Computer & Data Networks, ARPANET, ALOHA-Toke Protocols Network Topology, Multiple Access Schemes, Layered Architectures, Networks Protocols, Local Area Network, Evolution towards ISDN.

Course outcomes : At the end of this course students will demonstrate the ability to

1. To Understand basic concepts of telecommunication, networking and switching technologies
2. To learn in detail about time division switching.
3. To understand about various signaling in telecommunication systems
4. To analyze various telecommunication networks
5. To estimate the performance of telecommunication networks
6. Understands Multiple Access Schemes.

Text Book/Reference Books:

1. J. E. Flood,, Telecommunication and Switching Traffic & Networks, Pearson Education , 2001
2. Thiagarajan Viswanathan, Telecommunication Switching Systems & Networks, PHI , 2006

Reference Books:

1. John G. van Bose and Fabrizio u devetak, signaling in Telecommunication Networks, Wiley interscience. 2nd edition , 2007
2. Roger L. Freeman, Telecommunication System Engineering: Analog and Digital Network Design, John Wiley & Sons.

Data Communication Networking & Security

Course Code					
Category	Professional Elective Courses				
Course title	Data Communication Networking & Security				
Scheme	L	T	P	Credits	Semester : VII
	3	0	0	3	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. Understand the working principles of Data Communication.
2. Understand the Data link layer .
3. Understand the network security.

UNIT I

Overview of Data Communication and Networking: Data communications, Uses of computer Networks, The Internet, Protocols and standards, Layered tasks, OSI model, TCP/IP model. Data and Signals, Analog and Digital, Periodic Analog Signals, Digital Signals, Transmission impairment, Data Rate Limits, Performance, Digital Transmission, Digital-to-Digital Conversion, Analog-to-Digital Conversion, Analog Transmission, Digital-to-analog Conversion, Analog-to analog Conversion

UNIT II

Physical layer: Bandwidth utilization: Multiplexing, FDM, WDM, TDM, Transmission Media, Guided Media, Unguided Media: Wireless, Switching, Circuit-Switched Networks, Datagram Networks. Modulation of digital data, Telephone Network,

Data Link Layer: Data link layer design issues, Error Detection and Correction, Data Link Control and Protocols, Types of errors, Detection, Error correction, Flow and error control.

UNIT III

Network Layer: Internetworks, Addressing: IP Address Classes, Subnet, CIDR, Routing, ARP, IP, ICMP, IPV6, Unicast routing, Unicast routing protocol, Multicast routing, Multicast routing protocols.

Transport layer: Process to process delivery, Elements of transport protocols, User datagram protocol (UDP), Transmission control protocol (TCP), Data traffic, Congestion, Congestion control, Quality of service, Techniques to improve QOS, Integrated services, Differentiated services, QOS in switched networks.

UNIT IV

Application layer: DNS-Domain Name System, Electronic mail, File transfer, HTTP, World wide web (WWW), Digitizing audio and video, Audio and video compression, Voice over IP.

Network Security: Cryptography, Symmetric key Algorithms (DES, AES), Public key Algorithms-RSA, Digital Signatures, Firewall

Course Outcomes:

1. Describe the technical aspects of data communications on the Internet
2. Analyze error detection/correction and flow control of data in the data network
3. Configure the network component and assign IP address
4. Perform computations and solve numerical problems on different FDMA techniques.
5. Assess how softwarization of network functions helps in scalability and ease of operations.
6. Evaluate the use of advanced techniques in cellular communications.

Text Books/Reference Books:

1. Data Communication and Networking by Behrouz A. Forouzan (Fourth Edition), Tata McGraw Hill
2. Computer Networks by Andrew S. Tanenbaum (Fifth Edition), Pearson Education
3. Introduction to Data communications and Networking ,W.Tomasi, Pearson education
4. Stallings William, Data and Computer Communication, Pearson Education (2000) 7th ed.

Radar and Sonar

Course Code					
Category	**Professional Elective Courses**				
Course title	**Radar and Sonar**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. Understand the working principles of the Radar and Sonar .
2. Understand the types of Radars and their applications.
3. Understand limitations and latest development in Radar technology.

UNIT I

Introduction: Radar basic block diagram, operation, working principle, frequency used. Evolution of Radar technology and its application in various fields with historical prospective

UNIT II

Radar Equation: Simple form of Radar equation, prediction of range, performance, minimum detectable signal, Receiver Noise, Signal to Noise Ration. Transmitter power, Pulse repetition frequency, range ambiguity, system losses and propagation effects. CW and Frequency Modulated Radars: Basic block diagram of CW and FMCW radar. Working principle, application and limitations.

UNIT III

MTI and Pulse Doppler Radar: Introduction, Delay Line Cancellors, Multiple or staggered, Pulse repetition frequencies, range-Gated Doppler Filters, Digital Signal Processing, Other MTI delay line, Limitation of MTI performance, Non-coherent MTI, Pulse Doppler Radar, MTI from a moving platform. Tracking in Radar: Tracking with Radar, Sequential Lobbing, Conical Scan, Monopulse Tracking Radar, Tracking in range, Acquisition.

UNIT IV

Receivers, Display & Duplexers: Radar Receivers, Noise Figure, Mixer, Low-noise Front ends, Displays, Duplexer, Receiver protectors. Introduction to SONAR: Working principle, propagation, transmission and reception of signals. Signal to Noise Ration, types of Sonar and their applications

Course Outcome: At the end of the course, students will demonstrate the ability to:

1. Explain working principles of the Radar and Sonar .
2. Explain availability of various types of Radars and their applications.
3. Explain optimum utilization of Radar and Sonar technology.
4. Understand the principle and working of SONAR.

TEXT BOOK/ REFERENCE BOOK:

1. Introduction to Radar Systems: Merrill I. Skolnik, ; MGH
2. Electronic Communication Systems : Kennedy; TMH

Error Correcting Codes

Course Code					Semester : VII
Category	Professional Elective Courses				
Course title	Error Correcting Codes				
Scheme	L	T	P	Credits	
	3	0	0	3	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. Understand the encoding and decoding concept of the various codes.
2. Understand that using coding techniques how we improve the efficiency of communication system.
3. Understand various properties of different codes and how implements on different application.

UNIT I

Concept of information and entropy, Shannon theorem, Relation among Different entropies, Mutual information and self-information, channel capacity of different channels ,Basic conception of coding , Advantage of coding ,Source encoding and channel coding.

UNIT II

Linear block codes: introduction to linear block code. Syndrome and error detection Minimum distance of block code, Error detecting and error correcting capabilities of a block code, Hamming codes. Application of block codes for error control in data storage system.

UNIT III

Cyclic Codes: Description, Generator and parity check matrices, encoding, Syndrome computation and error detection, decoding, cyclic hamming codes, Shortened cyclic codes, error trapping decoding for cyclic codes. BCH codes, Decoding of BCH codes. Idempotent and Mattson-Solomon polynomials; Reed-Solomon codes, MDS codes,

UNIT IV

Convolution codes ; Encoding of convolutional codes, state diagrams, Trellis Diagram, structural and distance properties, Maximum likelihood decoding, sequential decoding algorithm, Application of convolutional codes in ARQ system. Introduction to Space time codes, Diversity, orthogonal space –time block codes.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Understand the sources of errors
2. Understand error control coding applied in digital communication
3. Understand the encoding and decoding concept .
4. Understand the coding techniques to improve the efficiency of communication system.
5. Understand various properties and their implements on different application.

Text/Reference Books:

1. F.J. McWilliams and N.J.A. Slone, The theory of error correcting codes, 1977.
2. R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.

Digital Audio Processing

Course Code					
Category	**Professional Elective Courses**				
Course title	**Digital Audio Processing**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester : VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

NOTE: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objective: The objectives of this course are as under:

1. To provide students with information about essential simulation methods and implementation procedures in the area of digital audio signal processing.
2. Considerable attention is devoted to the present trends in the area of general audio signal with focus on musical signals.

UNIT I

Audio Signal Characteristics, Production model, Hearing and Auditory model, Acoustic characteristic of speech, Speech production models, Linear Separable equivalent circuit model, Vocal Tract and Vocal Cord Model , Audio signal acquisition, Representation and Modelling, Enhancement of audio signals: Spectral Subtraction, Weiner based filtering, Neural nets

UNIT II

Audio/ Speech Analysis and Synthesis Systems: Digitization, Sampling, Quantization and coding, Spectral Analysis, Spectral structure of speech, Autocorrelation and Short Time Fourier transform, Window function, Sound Spectrogram, Mel frequency Cepstral Coefficients, Filter bank and Zero Crossing Analysis, Analysis –by-Synthesis, Pitch Extraction., Linear Predictive Coding Analysis.

UNIT III

Psychoacoustics, Multi-microphone audio processing: Room acoustics, Array beamforming. Acoustic sound source localization and tracking

UNIT IV

Applications: Principles of Automatic Speech Recognition (ASR),Theory and implementation of Hidden Markov Model (HMM) for ASR, Speaker Recognition, Evolution of Speech APIs, Natural Language Processing, Sound source separation models.

Course Outcomes: At the end of this course, the students should be able to

1. Understand different characteristics of Audio signals.
2. Analyze different speech analysis and synthesis systems.
3. Write an algorithm for automatic speech recognition system
4. Design models and algorithms for audio and speech processing applications.

Text/References Books :

1. Sen, Soumya, Dutta, Anjan Dey, Nilanjan, Audio Processing and Speech Recognition,1st edition, 2019, Springer
2. Gold, B.; Morgan, N.; Ellis, D. Speech and audio signal processing: processing and perception of speech and music. 2nd rev. ed. Wiley-Blackwell, 2011.
3. Bali & Bali, Audio Video Systems, Khanna Book Publishing.
4. Sadaoki Furui, "Digital Speech Processing, Synthesis and Recognition" 2/e.
5. Rabiner and Schafer, "Digital Processing of Speech Signals", Pearson Education

Gurugram University Scheme of Studies and Examination
Bachelor of Technology (Electronics & Communication Engineering)

Semester VIII

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	ESC		MOOC –I (Essential)	3	0	0	3	25	75	100
2	ESC		MOOC-II (Essential)	3	0	0	3	25	75	100
3	PROJECT		Project – III/Industrial Training	0	0	16	8	150	150	300
Total				**22**			**14**	**200**	**300**	**500**

NOTE: At the end of the 8th semester, each student has to submit the certificate of MOOCs (Essential).

MOOC-1(ESSENTIAL)

Course Code					
Category	**Engineering Science Course**				
Course title	**MOOC-1 (Essential)**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VIII**
	3	**0**	**0**	**3**	
Class Work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

A student has to complete NPTEL/SWAYAM Courses of 12 Weeks respectivelythrough MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL/SWAYAM Site http://nptel.ac.in/ as per the NPTEL policy and norms. The students can register for these courses through NPTEL/SWAYAM directly as per the course offering in Odd/Even Semesters at NPTEL/SWAYAM. These NPTEL/SWAYAM courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCS courses the students, shall, provide their successful completion NPTEL/SWAYAM status/certificates to the University (COE) through their college of study only.

MOOC-2(ESSENTIAL)

Course Code					
Category	**Engineering Science Course**				
Course title	**MOOC-2 (Essential)**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VIII**
	3	**0**	**0**	**3**	
Class Work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

A student has to complete NPTEL/SWAYAM Courses of 12 Weeks respectively through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL/SWAYAM Site http://nptel.ac.in/ as per the NPTEL policy and norms. The students can register for these courses through NPTEL/SWAYAM directly as per the course offering in Odd/Even Semesters at NPTEL/SWAYAM. These NPTEL/SWAYAM courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCS courses the students, shall, provide their successful completion NPTEL/SWAYAM status/certificates to the University (COE) through their college of study only.

INDUSTRIAL PROJECT/PROJECT-III

Course Code					
Category	**Project**				
Course title	**Industrial Project/Project-III**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VIII**
	0	**0**	**16**	**8**	
Class Work	150 Marks				
Exam	150 Marks				
Total	300 Marks				
Duration of Exam	3Hrs				

Course objectives:

1. To allow students to demonstrate a wide range of the skills learned during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation
2. To encourage multidisciplinary research through the integration learned in a number of courses.
3. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation

The students are required to undergo industrial training or institutional project work of duration not less than 4 months in a reputed organization or concerned institute. The students who wish to undergo industrial training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the midterm progress report at the institute. the presentation will be attended by a committee. alternately the teacher may visit the industry to get the feedback of the student.

The final Viva voice of the industrial training or institutional project work will be conducted by an external examiner and one external examiner appointed by the institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the board of studies in engineering and technology. Assessment of industrial training or institutional project work will be based on seminar, yiva-voice, report and certificate of industrial training or institutional project work obtained by the student from the industry or institute.

The internal marks distribution for the students who have undergone industrial training consist of 150 marks internally and 150 marks buy an external examiner.

Course outcomes

On successful completion of the course students will be able to:

1. Demonstrate a sound technical knowledge of their selected project topic.
2. Undertake problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilising a systems approach.
4. Conduct an engineering project.
5. Communicate with engineers and the community at large in written an oral form.
6. Demonstrate the knowledge, skills and attitudes of a professional engineer.