SEMESTER V

(TR 501) Industrial Training

1. AIM

To expose & prepare the students for the Industrial work situation. This exposure and hands on experience will further enhance the prospects of student fraternity to be better placed on completion of their course.

2. COURSE OBJECTIVES:

The students will able to:

i. Understand functions of various departments of the industry while working in the industry.
ii. Observe & familiarize with features of raw materials, machines, tools, products & processes of the particular industry
iii. Work in the team to develop teamwork, leadership & communication skills
iv. Develop technical skills as well as soft skills

3. PRE-REQUISITES:

i) Basic Engineering Skills

4. TEACHING AND EXAMINATION SCHEME

Semester V									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
(TR 501) Industrial Training	0	0	4	4	-	-	30	70	GRADE

08 Weeks

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the organizational set up & functions of various departments in the industry
2. Apply the knowledge gained in the institute to correlate with the actual processes in the industry & Compile relevant data in the form of a report.
3. Develop leadership, teamwork & communication skills while having hands on experience in the industry
4. Demonstrate consciousness towards safety & environment by adapting to the rules & regulations of Industry

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life Learning
CO1	2	1	2	2	3	3	3
CO2	3	3	2	3	3	3	3
CO3	1	2	2	2	3	3	3
CO4	1	2	1	2	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

1.1 Students are required to study and have hands-on experience wherever possible in the following areas (depending on availability):

- Company Profile
- Organizational Structure
- Company Product Range
- Manufacturing Facilities Available /Services provided
- Plant / Facility Layout
- Operations / Production Processes
- Production Planning and Control
- Detail study of Latest Equipment/ Technologies Used
- Stores Functions
- Material Handling Systems/ Equipment
- Quality Management Systems / Functions
- Maintenance and Repair Practices
- Safety Practices / Safety Equipment
- Utilities
- Logistics
- Sales and Marketing
- Ethics, Statutory Rules and Regulations followed
- Product Design and Development
- Any other area specific to the Industry providing Training

8. TERM WORK & PRACTICALS

Evaluation Scheme					
TW				**PR/OR**	TOTAL Marks
Attendance Marks*	Industrial Mentor's assessment Marks	Institute Mentor's assessment Marks	Training Report	Report Assessment & Seminar/Viva	
10	**20**	**20**	**20**	**30**	**100**

* 01 mark shall be deducted for every Absence (with or without permission).

Daily Dairy:
The daily dairy should-be maintained in a book. It should reflect the day to day activities performed by the student (including task, men and materials involved). It should be counter signed by the Industry Mentor. It will become the basis for writing reports on the complete training.

Training Report
The training report should be submitted by the training students should include the following salient points- Certificate from institute, Certificate of training from company, detailed write up as per daily dairy, detailed drawings, working drawings, photographs, safety precautions, techniques for work minimization on site, organizational chart, Importance of project to the society, special methods/techniques/equipment should be separately high lightened, including environmental aspects. The report should be informative and technical, typed with double spacing on good quality bond paper and bound. Assessment of Training Report be based on Knowledge, Presentation, and Quality of contents and sketches.

Note:
a. Student/s undergoing Industrial Training shall follow Rules and Regulations of the Industry.
b. Industrial Training will generally be organized and conducted in accordance with Industrial Training Manual duly prescribed by the Board.

9. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS

Unit No	Name of the Unit	Teaching Hours	Marks
1	**PR/OR**	**08 weeks**	**30**
2	**TW**		**70**
	Total	**08 weeks**	**100**

Note:

1. For Industrial training Grades will be awarded based on marks scored as follows:

80% and above Marks – Grade 'A'
60% to 79% Marks – Grade 'B'
40% to 59% Marks – Grade 'C'
Marks below 40% - Grade 'D'

2. TW and PR/OR shall be separate heads of passing. Student has to secure minimum Grade 'C' for passing.

(CC 602) BUSINESS COMMUNICATION

1. COURSE OBJECTIVES:

The students will able to:

1. Use speaking, writing and presentation skills to communicate effectively.
2. Develop business etiquettes, manners, grooming and improve personal appearance
3. Improve non-verbal forms of communication.

2. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	H	TH	TM	TW	PR/OR	
(CC 602) BUSINESS COMMUNICATION	-	-	2	2	-	-	25	25	50

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

GC602.CO1: Apply principles of effective communication in business environment

GC602.CO2: Use ICT in business communication effectively.

GC602.CO3: Demonstrate soft skills required in business environment.

GC602.CO4: Prepare technical writing for various functions of business communication

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	1	0	1	0	1	2	2	0	1
CO2	2	2	2	1	2	2	3	1	2
CO3	2	2	2	1	2	2	3	1	2
CO4	1	1	1	1	2	3	3	0	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Phr = Practical hours	CO = Course Outcomes

Unit	M	Phr	CO
1 COMMUNICATION SKILLS AT WORKPLACE			
1.1 **Principles of communication in business** Importance of communication in a business organization, types of communication (formal and informal Internal and External Communication), Channels of communication: Vertical, Horizontal, Diagonal, Grapevine		04	CO1 CO2 CO3 CO4
1.2 **Modern Office technology for communication**: email communication and sending text (etiquettes, components, tips for writing effective emails, spellcheck), internet and use of social media for work (to communicate, search for information about suppliers, specifications, networking, quick feedback, e-commerce, video conferencing)			
2 SEMINARS			
2.1 **Organization of seminars and workshops** Organizers role: planning, objectives, topic selection, planning the date, time, venue, creating event organization material: creating Facebook page, WatsApp group, invitations, advertisement on pamphlet, hand-outs, signage, name badges, registration form, press note, inviting key note speaker, schedule		06	CO1 CO2 CO3 CO4
2.2 **Presentation** Speakers role: Gathering relevant material, organization of the material, knowing the occasion and audience, preparing handouts for distribution, time management, interaction with audience, non-verbal communication. (Checklist of significant aspects of oral presentation to be provided)			
2.3 Role of audience Audience's role: Listening effectively and asking relevant questions, note taking			
3 TECHNICAL WRITING			
3.1 Reports Understanding objective report writing, types of reports, parts of a formal report, illustrations inspection reports: procedure and format, Project Report		10	CO1 CO2 CO3 CO4
3.2 Business letters Sales letters: parts of sales letter complaint letters: elements of a complaint letter adjustment letters: elements of an adjustment letter			

3.3 Tenders procedure, Preparation, Types of tenders, Single tender, limited tender, Open tenders, government e tender, structure of a tender document, tender notice, terms and conditions, payment details, specification, documents to be submitted, drafting advertisement for tender. **3.4** Generic notices, notice for meetings: purpose, format of notice for meeting, agenda, quorum and writing minutes			
4 JOB INTERVIEWS			
4.1 Job application and resume draft job application and resume, draft letter of acceptance and cold contact letter		06	CO1 CO2 CO4
4. 2 **Job interviews** preparing for job interview, guidelines on facing job interviews, mock interviews			
5 SOFT SKILLS **5.1Business etiquettes** Importance of business etiquettes and manners, Tips for good business etiquettes		06	CO1 CO2 CO3 CO4
5.2 **Nonverbal Communication** grooming, personal appearance, hygiene, deportment and body language 5.3 **Interpersonal skills** Leadership skills, team work, active listening 5.4 **Critical thinking** How to improve critical thinking, tips for critical thinking			
Total		**32**	-

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	
	Practical Title	**Marks 25**
1.	Modern office technology	
2.	Seminar	03
3.	Technical writing	03
4.	Job interviews	10
5	Soft skills	04
	Total	05
		25
No	**Class room Assignments**	
1	Email communication	
2	Power point presentation	

3.	Drafting seminar invites	
4.	Drafting hand outs for seminars	
5	Drafting sales letter	
6	Drafting complaint letters	
7	Drafting adjustment letters	
8	Drafting tender notice	
9.	Filling maintenance reports	
10.	Drafting inspection reports	
11	Drafting abstract	
12	Drafting notice for meetings	
13	Drafting agenda of meetings	
14	Drafting minutes of meeting	
15	Drafting resume and job application	
16	Drafting letter of acceptance	
17	Drafting cold contact cover letter	
18	Group discussions	
19	Debates	
20	Group presentations	

8. LEARNING RESOURCES

8.1 Reference books

S. No.	Author	Title of Books	Publishers
1	P.Prasad, Rajendra k. Sharma	The functional aspects of communication skills	s.k. kataria &sons
2	Pal & Rorualling	Essentials of business communication	Sultan chand & sons
3	Grount Taylor	English conversation practice	Tata MCgraw Hill
4	R.C. Sharma & Krishna Mohan	Business Correspondence & report writing	Tata MCgraw Hill

(EX 501) PROGRAMMABLE LOGIC CONTROLLERS (PLC)

1. AIM

1. To introduce students to PLC Hardware and programming concepts

2. COURSE OBJECTIVES / RATIONALE:

The students will able to:

1. To understand working of a PLC based System.
2. Write simple programs using ladder symbols and functional blocks.

3. PRE-REQUISITES:

Students should know

1. Working of Digital Circuits like Shift Registers, Counters, ADC and DAC.
2. Working of a Relay and Power electronic devices like Diac and Triac.

4. TEACHING AND EXAMINATION SCHEME

Semester	V								
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
		L	T	P	C	TH	TM	TW	PR/OR	
(EX 501) PROGRAMMABLE LOGIC CONTROLLERS (PLC)		3	-	2	5	75	25	25	-	125

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Describe the hardware and I/O interface of PLC system.
2. Describe the procedures to commission and test PLCs in Industrial Automation Systems.
3. Develop and troubleshoot ladder programs for PLCs.
4. Design a simple automated system using PLCs.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society,Sustainability & Environment	Project Management	Life -long Learning
CO1	2	0	1	0	0	2	2
CO2	2	2	1	2	2	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	2	1
CO4	2	1

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1. PLC HARDWARE	**18**	**12**	**CO 1**
1.1 Introduction: Definition, Features, Advantages, Applications			
1.2 Types of PLC : Single box & Modular, Small, Medium and Large PLC			
1.3 PLC system: General Block diagram, Internal architecture (block diagram): CPU, Buses & Memory.			
1.4 Input and output: Types of I/O signals – Analog, Digital and Discrete Types of I/O Connections – Sourcing and Sinking Input Units: DC input unit, AC input Unit and Analog input Unit. Output Units: Basic forms of Relay output unit, transistor output unit and Triac output unit. I/O Addressing: The general format of an I/O address.			
2. PLC Instructions and Functional Blocks	18	12	**CO 3** **CO 4**
2.1 PLC ladder diagram conventions, rules, standard IEC 1131-3 symbols.			
2.2 Data handling instructions – Data movement (MOV), Data comparison (EQUAL, NOT EQUAL, LESS THAN, LESS THAN OR EQUAL, GREATER THAN, GREATER THAN OR EQUAL, MASKED COMPARISON FOR EQUAL, LIMIT TEST)			
2.3 Mathematical instructions(ADD, SUBTRACT, MULTIPLY,			

DIVIDE, SQUARE ROOT)			
2.4 SET and RESET Instructions			
2.5 Subroutine: call to subroutine, return to main program			
2.6 Shift registers: Introduction, function, (SHIFT LEFT, SHIFT RIGHT, SHIFT 1 BIT AND 4 BIT AT A TIME).			
2.7 Internal Relays: Function of internal relays, Addressing of internal relays, battery backed relays, master control relay.			
3. TIMERS & COUNTERS	12	8	**CO 3 CO 4**
3.1 Timers: Function and list of applications of On-delay timers, Off-delay timers, Retentive Timers, Non retentive Timers, Pulse timers, Cascaded timers.			
3.2 Timer Parameters: Preset value, Time base, Total time delay, Significance of Timer timing and Timer Out.			
3.3 Counters: Function and list of applications of Up and Down counters.			
3.4 Counter Parameters: Preset value, Accumulated Value, Clock Input and counter Overflow and Underflow indications			
4. PROGRAMMING a PLC	15	8	**CO 3 CO 4**
4.1 ladder programs to represent logic functions (AND, OR, NOT, NAND, NOR, XOR)			
4.2 ladder programs for switches, latching circuits, multiple outputs and sequenced outputs			
4.3 Ladder programs and functional block diagrams from boolean expressions(POS, SOP)			
4.4 Simple Ladder programs using data handling and mathematical instructions.			
4.5 Simple Ladder programs using internal relay, master control relay and shift register.			
4.6 Simple Ladder programs using timers and counters			
5. DESIGNING SYSTEMS	**12**	**8**	**CO 2**
5.1 Brief overview of steps in systematic designing of a PLC based System.			
5.2 Safety in PLCs – emergency stop relays.			
5.3 Commissioning a PLC – Testing of inputs & outputs, Testing Software, and Simulation.			
5.4 Fault finding: Fault detection techniques – timing checks, last output set, replication and expected value checks.			
5.5 Brief overview of System documentation.			

8. COURSE DELIVERY:
The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	PLC HARDWARE	12	18
2	PLC INSTRUCTIONS AND FUNCTIONAL BLOCKS	12	18
3	TIMERS & COUNTERS	08	12
4	PROGRAMMING A PLC	08	15
5	DESIGNING SYSTEMS	08	12
		48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Introduction to the PLC simulation software.	
2.	Compare Specifications of different PLCs	
3.	Ladder programming for logical functions	
4.	Ladder programming for latching functions	
5.	Ladder programming for data manipulation functions	
6.	Ladder programming for mathematical functions	
7.	Ladder programming for shift registers functions	
8.	Ladder programming for internal relay and master control relay functions.	
9.	Ladder programming for timer functions	
10.	Ladder programming for counter functions	
11.	Micro Project (simple Application)	
No	**Class room Assignments**	**Marks**
1	Atleast 02 assignments.	
...		
No	**Tutorial Exercise**	**Marks**
1	To be decided by the subject teacher as per requirements	
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	William Bolton	Programmable Logic Controllers 5th Edition	ELSEVIER, Newnes. ISBN:978-93-80501-46-8
2	Frank D Petruzella	Programmable Logic Controllers 3rd Edition	McGraw Hill Higher Education or TMH

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Madhuchhanda Mitra, Samarjit Sen Gupta	PLC & Industrial Automation an introduction 5th Edition	PENRAM International publishing ISBN:9788187972297
2	John W. Webb, Ronald A. Reis	Programmable Logic Controllers: Principles and Applications 5th Edition	Prentice Hall of India ISBN :978-8120323087
3	George Batten	Programmable Logic Controllers.	Tata McGraw Hill

(CC601) INDUSTRIAL ORGANISATION AND MANAGEMENT

1. COURSE OBJECTIVES:

Management is the basic need of any organization. Organization consists of multiple activities which are to be systematically managed for effective output. The course covers various principles related to organization and management. The areas covered are finance, human resource, project management etc. After completion of the course, the student will be acquainted with management and other related aspects so that he/she will be able to apply this knowledge in order to achieve the organizational goals.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (in hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CC601 INDUSTRIAL ORGANISATION AND MANAGEMENT	L	T	P	H	TH	TM	TW	PR/OR	100
	3	-	-	3	75	25	-	-	

3. COURSE OUTCOMES

On successful completion of the course, the student will be able to:

CC601.CO1: Describe types of business organizations.

CC601.CO2: Apply the principles of managing Men, Machines, and Materials in an industry.

CC601.CO3: Evaluate financial status of an industrial organization.

CC601.CO4: Develop problem solving skills in project management.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	0	0	0	0	1	0	1	2
CO2	2	1	1	1	1	2	2	1	3
CO3	3	2	1	2	3	3	2	1	3
CO4	3	3	2	2	2	3	3	2	3

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS/ MICRO-LESSON PLAN

M=Marks | Thr= Teaching hours | CO= Course Outcomes Unit	M	Thr	CO
1.BUSINESS ORGANIZATION **1.1** Types of business organizations: Individual proprietorship, Partnership, Joint Stock Companies: Private Ltd and Public Ltd, Co-operative societies, Public sector **1.2** Structure of business organization: Line organization, Functional Organisation, Line and staff organization, Project organization	10	6	CO1 CO2
2.BUSINESS MANAGEMENT **2.1:** Concept of management and administration, management as an art and science, evolution and growth of scientific management- contribution of F.W Taylor. **2.2** Basic functions of management: planning, organizing, staffing, directing, controlling. Other functions: forecasting, coordinating and decision- making. **2.3** Functions in Industry: Basics of Procuring, store- keeping, material handling, production, packing and forwarding, marketing and sales, supervision, research and development. **2.4**Supervisory skills required in industry	16	9	CO1 CO2 CO3
3.BASICS OF FINANCE **3.1** Sources of finance **3.2** Cost Concepts: Necessity of costing, elements of cost: material, Labour and expense; prime cost, overhead cost, total cost, And break- even analysis. **3.3** Materials management: Inventory control-standard order, reserve stock, reorder point, lead time. Economic order quantity, ABC Analysis. Introduction to Just in time (JIT) system **3.4** Depreciation: Definition and causes. Methods of calculating depreciation charges: Straight Line Method, Diminishing Balance Method, Sinking Fund method .(Simple Numericals) **3.5** Obsolescence- definitions and reasons. **3.6** Introduction to GST.	18	13	CO1 CO2 CO3 CO4
4.HUMAN RESOURCE MANAGEMENT **4.1** Functions of Personnel Department: Human resource planning, selection and recruitment, training, promotion and transfer, welfare of employees. **4.2** Industrial Relations: Employer-employee relations, trade union, settlement of disputes of employees, collective bargaining, conciliation, arbitration, grievance handling mechanism. **4.3** Wages and Incentives: Factors influencing wages, types of wage plans – time rate and piece rate, Incentive – objectives and types, individual and group incentive plan, characteristics of a good wage or incentive plan, difference between incentive and	21	14	CO1 CO2 CO3 CO4

wage. **4.4** Industrial Acts: Introduction to the following Industrial Acts: Industrial Disputes Act 1947/1956; The Indian Factories Act 1948 The Workmen's Compensation Act 1923			
5.PROJECT MANAGEMENT **5.1** Introduction to Project Management **5.2** Network Analysis (Introduction to basic concepts with simple Numericals) CPM- Critical Path Method: Definition, network diagrams, critical path, advantages PERT- Programme Evaluation and Review Technique: Definition, network diagrams, advantages. Comparison of PERT and CPM.	10	6	CO1 CO2 CO3 CO4
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Business Organization	6	10
2	Business Management	9	16
3	Basics of Finance	13	18
4	Human Resource Management	14	21
5	Project Management	6	10
	Total	**48**	**75**

8. LEARNING RESOURCES

Text Books

S. No	Author	Title of Book	Publisher
1	O.P. Khanna	Industrial Engineering and Management	Dhanpat Rai Publications
2	T. R. Banga ,S.C. Sharma	Industrial Organisation and Engineering Economics	Khanna Publishers
3	Awate, Chunawala, Patel, Bhandarkar, Sriniwasan	Industrial Organisation and Management	Vrinda Publication
4	Martand Telsang	Industrial Engineering and Production Management	S.Chand & Company Ltd

AUDIT COURSE

(AC101) ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

1. COURSE OBJECTIVES:

This course aims at imparting basic principles of thought process, reasoning and inferencing by human being. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of Yogis, science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course thus focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system.

2. TEACHING AND EXAMINATION SCHEME

Semester	V								
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(AC101) Essence of Indian Knowledge and Tradition		L	T	P	H	TH	TM	TW	PR/OR	
		2	-	-	2	-	-	-	-	-

Course Content:

Basic Structure of Indian Knowledge System:

(i) वेद (ii) उपवेद(आयुर्वेद धनुर्वेद गान्धर्ववेद स्थापत्यवेद) (iii) वेदांग (शिक्षा कल्प निरुक्त व्याकरण ज्योतिष छंद) iv) उपांग (धर्मशास्त्र मिमांसा पुराण तर्कशास्त्र)

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

S. No.	Title of Book	Author	Publication
1.	Cultural Heritage of India-Course Material	V. Sivaramakrishna	Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2.	Modern Physics and Vedant	Swami Jitatmanand	Bharatiya Vidya Bhavan
3.	The wave of Life	Fritzof Capra	
4.	Tao of Physics	Fritzof Capra	
5.	Tarkasangraha of Annam Bhatta, Inernational	V N Jha	Chinmay Foundation, Velliarnad, Amakuam
6.	Science of Consciousness Psychotherapy and Yoga Practices	RN Jha	Vidyanidhi Prakasham, Delhi, 2016

ELECTIVES – SEMESTER V

149

(EX 614) Audio & Video Engineering

1. AIM

1. To enable the students to understand the concept of sound & video recording.
2. To enable them to analyze composite video signal B/W as well as colour & VSB modulation.
3. To enable them to understand performance of B/W & colour picture tube, TV transmitter & receiver.
4. To introduce LCD & LED TV block diagrams.
5. To understand the performance of HDTV, CCTV. DTH etc.

2. COURSE OBJECTIVES :

The course will introduce the students with working principle, block diagrams of sound transducers, B/W & colour TV, LCD, LED TV, CCTV, DTH, HDTV, cable TV so that they will be able to install, test & troubleshoot simple faults in audio & Video equipment.

1. PRE-REQUISITES:

Students should know
1 .Electronic Circuits
2. Analog Communication

4. TEACHING AND EXAMINATION SCHEME

Semester	V									
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(EX 614)		L	T	P	C	TH	TM	TW	PR/OR	
Audio & Video Engineering		3	-	2	5	75	25	25	25	150

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1.Understand various concepts and characteristics of Audio Transducers.
2 Describe applications of TV such as CCTV, CATV, HDTV, DTV, DTH, LCD & LED TV.
3.Differentiate between various audio & Video recorder formats.
4. Analyze and compare B/W & colour TV system

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopme of nt	Engg. Tools, Experime ntatn&	Engg. Practices for Society,Su stainabilit & y	Project Managem ent	Life -long Learning
CO1	2	0	0	3	0	0	3
CO2	2	1	0	3	0	0	0
CO3	2	0	2	0	0	3	3
CO4	2	1	2	3	0	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1 SOUND TRANSDUCERS	**15**	**9**	**CO 1**
1.1 Characteristics: sensitivity, signal to noise ratio, directivity, output impedance, distortion and frequency response			
1.2 Requisites of a good microphone. Construction, functioning, features, and applications of microphones: Crystal, Moving coil. And Electret.			
1.3 LOUD SPEAKERS: Characteristics of loudspeaker Working principles of horn type and electrodynamic type loudspeaker Baffles(Finite, infinite ,bass reflex & acoustic labyrinth) Enclosure, Multiway speaker system (Woofers & Tweeters),surround sound system(block diagram)			
2 TV COMMUNICATION SYSTEM	18	12	**CO 4**
2.1 TV PICTURE ANALYSIS: -Frequency range of various VHF/UHF band, Aspect ratio, Persistence of vision.			
2.2 Scanning: Need, Sequential scanning, flicker, interlaced scanning, interlace error, interlace error calculation, horizontal scanning, vertical scanning			
2.3 Composite Video Signal (CVS) .need for synchronization, Horizontal			

sync and blanking pulses, Vertical sync and blanking.(No equalizing pulses).			
2.4 TV Camera tube: Characteristics of camera tube, construction and working of vidicon			
2.5 VSB Modulation			
3 COLOUR TELEVISION	18	10	**CO 4**
3.1Compatibility of color TV system with monochrome system.			
3.2 Additive and subtracting mixing of colours, luminance, Hue and Saturation			
3.3 Block diagram of video camera and its explanation			
3.4 Construction and working principles of Trinitron picture tube.			
3.5 Colour signal transmission, signal modulation, transmission, bandwidth, weighing factors & chrominance signal			
3.6 Block diagram of PAL TV transmitter & receiver.			
4 TYPES OF TV & APPLICATIONS	15	11	**CO 3**
a. Introduction to DIGITAL TV (DTV):Advantages (picture quality, special features, special effects, high reliability) Digital Video production & Reproduction (Block Diagram) Digital picture transmission & Reception (Block Diagram) Picture in picture feature in DIGITAL TV Principles of working HDTV			
4.2 Principle of working, features& Block diagram of Cable TV, PAY TV THROUGH CABLE,CCTV and DTH.			
4.3 LCD TV & LED TV: Introduction & block diagram			
4.4 Night vision camera			
5 VIDEO RECORDING & PRODUCTION	9	6	**CO 3**
5.1 Comparison VCD verses DVD			
5.2 DVD formats, recording and playback on DVD			
5.3 Introduction to BLU-RAY DISC, Block diagram BD player & operation			
5.4 Comparison of BLU-RAY &DVD			
Total	**75**	**48**	

8. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies.

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Sound Transducers	9	15
2	TV Communication system	12	18
3	Colour Television	10	18
4	Types of TV & Applications	11	15
5	Video Recording & Production	6	9
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Test performance of pattern generator.	
2	Compare composite video signal (B/W) of different patterns	
3	Test performance of picture tube (B/W).	
4	Compare composite video signal (colour) of different patterns.	
5	. Test performance of TV receiver controls	
6	Test performance of picture tube (colour)	
7	Tracing of different sections of TV receiver	
8	Location of faults in the different sections of TV receiver	
9	. Study of a TV cable network system through internet	
10	Study of a CCTV system through internet	
No	**Class room Assignments**	**Marks**
1	At least 02 assignments	
2		
...		
No	**Tutorial Exercise**	**Marks**
1		
2		
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.R Gulati	Modern Television Practice Principles,Technology and Servicing 2/Ed	New age Internationl Publisher, New Delhi **ISBN-** 9788122413601
2	. R.R Gulati	Composite Satellite & cable Television	New age Internationl Publisher, New Delhi **ISBN-** 9788122413601
3	A.M.Dhake	TV and Video Engineering	TMH Publication, New Delhi **ISBN**: 9780074601051
4	Gordon J King	Audio Handbook	Newnes-Butterworth **ISBN-13:**9780408001502
5	Maini	Colour T.V. and Video Technology	PHI Publications. New Delhi
6	K.D. Desai,	Video Cassette Recorders	Jeevan Deep Prakashan, Mumbai, 2nd , 1988
7	Ibrahim, K.F. Newnes	Guide to Television and Video Technology, Fourth Edition	Newnes-Butterworth **ISBN-13:** 9780750681650
8	John D. Lenk	Complete Guide To Laser Video Disc	PHI Publications. New Delhi, 2nd, 1995
9	R.G.Gupta	Television Engineering and video systems . second edition	second edition ,MH New Delhi
10	R.G.Gupta	Audio &Video Systems	TataMc-GrawHill education ,Delhi.
10	LCD LED Screen Panel Repair Guide	http://lcdrepairguide.com/screen-repair/	

(EX613) Advanced Microcontroller

1. AIM:

To understand advanced microcontroller concepts, interface ARM microcontroller to external hardware and program ARM-based systems for various applications

2. COURSE OBJECTIVES / RATIONALE:

Students will be able to:

1. Understand advanced microcontroller concepts
2. Interface ARM microcontroller to external hardware
3. Program ARM-based systems using assembly and embedded C languages

3. PRE-REQUISITES:

Students should have the knowledge of:

1. Digital electronics and number systems
2. Basic microcontrollers
3. Computer programming and assembly language programming

4. TEACHING AND EXAMINATION SCHEME

Semester	V									
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(EX613) Advanced Microcontroller		L	T	P	C	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	25	150

5. COURSE OUTCOMES:

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

1. Recall and explain the features of ARM7TDMI microcontroller
2. Compare/contrast and select appropriate interface for a given application
3. Develop, execute and debug assembly language and embedded C programs for various applications
4. Interface ARM7TDMI microcontroller with hardware for various applications

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentatn&	Engg. Practices for Society,Sustainability &	Project Management	Life -long Learning
CO1	2	3	3	0	0	0	3
CO2	0	3	3	0	0	0	3
CO3	0	3	3	3	3	3	3
CO4	2	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

Mapping Course Outcomes with Program Specific Outcomes

	PSO1	PSO2
CO1	3	0
CO2	3	0
CO3	3	3
CO4	3	3

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**		
Unit		**M**	**Thr**	**CO**
1 Introduction to ARM7TDMI		**12**	**7**	**CO1**
1.1 ARM7TDMI architecture, block diagram, functional diagram				
1.2 ARM7TDMI register set, 32-bit CPU registers, CPSR and SPSR registers				
1.3 ARM7TDMI three-stage pipeline				
1.4 Memory map and memory interfacing, implementation of stack				
1.5 AMBA overview				
2 ARM7TDMI on-chip peripherals		**18**	**12**	**CO1**
2.1 Timer – features, pin and register description, timer-handling				
2.2 Serial port – configuration, interfacing PC with microcontroller, UART0 and UART1-handling				
2.3 Interrupt – IRQ, FIQ, ISR and interrupt-handling				
2.4 ADC – built-in ADC, interfacing external device to ADC				
2.5 PWM – register description, application				
2.6 Real time clock – RTC features, RTC register description, RTC interrupts				
2.7 Flash – flash memory system				

2.8 Watchdog timer			
3 Communication protocols for interfacing	**10**	**6**	**CO2**
3.1 I2C interface – features, architecture, pin and register description, applications			
3.2 SPI interface – features, architecture, pin and register description, applications			
3.3 Introduction to CAN interface			
4 ARM7TDMI instruction set and programming **(Students to be examined on assembly language programs that can include a combination of any instructions. Minimum instruction set should be provided to students during the examination)**	**20**	**13**	**CO3**
4.1 32-bit ARM instruction set			
4.2 16-bit THUMB instruction set			
4.3 Simple programs using different types of ARM instructions			
5 Interfacing ports to external devices	**15**	**10**	**CO4**
5.1 Hardware interfacing to output devices and programming - LED, seven-segment LED display, LCD, motor			
5.2 Hardware interfacing to input devices and programming - Switches, matrix keypad			
5.3 Hardware interfacing to sensors and programming - IR, temperature sensors			
Total	**75**	**48**	

8. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies, laboratory practical, etc.

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction to ARM7TDMI	7	12
2	ARM7TDMI on-chip peripherals	12	18
3	Communication protocols for interfacing	6	10
4	ARM7TDMI instruction set and programming	13	20
5	Interfacing ports to external devices	10	15
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
	Minimum eight to be performed	
1.	Program to add n binary numbers	
2.	Programming of timer for 8-bit PWM Generation	
3.	Programming of timer for variable frequency square wave generation	
4.	Programming of timer for frequency measurement and display on LCD	
5.	Programming of on-chip ADC	
6.	Programming of SPI port for interfacing with ADC MCP3304	
7.	Programming of SPI port for interfacing with DAC MCP4822	
8.	Programming of GPIO port for LED flashing	
9.	Programming of GPIO port for key interface	
10.	Programming of timer for accurate delays	
11.	Programming of UART for interfacing with PC	
	Total	25
No	**Class room Assignments**	**Marks**
	Atleast 2 assignments	
No	**Tutorial Exercise**	**Marks**
	To be decided by the subject teacher	

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Andrew N.SLOSS, Dominic SYMES and Chris WRIGHT	ARM System Developers Guide, Designing and Optimizing System Software	ELSEVIER
2	Steve Furber	ARM System-on-Chip Architecture, Second Edition	PEARSON

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	William Stallings	Operating Systems	Pearson

(EX611) Biomedical Instrumentation

1. AIM

Students of electronics engineering related branches opting for this course will be introduced to the basic concepts of biomedical instrumentation enabling them to pursue a career in the health care sector.

2. COURSE OBJECTIVES:

The students will able to:

1. Assist doctors in a hospital as biomedical engineers.
2. Work as service engineers for medical equipment maintenance.

3. PRE-REQUISITES:

1. Knowledge of basic principles of physics
2. Knowledge of basic electronics
3. Knowledge of sensors and transducers

4. TEACHING AND EXAMINATION SCHEME

Semester V									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX611) Biomedical Instrumentation	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Demonstrate a knowledge of the working principles of clinical laboratory instruments
2. Perform various physiological measurements
3. Perform pulmonary function measurements
4. Demonstrate a knowledge of medical imaging equipment and nuclear medicine

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentatn&	Engg. Practices for Society,Sustainability &	Project Management	Life -long Learning
CO1	2	0	1	3	2	0	0
CO2	3	0	1	3	3	0	2
CO3	2	0	1	2	3	0	0
CO4	2	0	1	1	3	0	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	0
CO2	2	1
CO3	2	1
CO4	2	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**TH= Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**TH**	**CO**
1 CLINICAL LABORATORY INSTRUMENTS			**12**	**08**	**CO1**
1.1 Medical diagnosis with chemical test, principles of spectrophotometry, colorimeters and clinical flame photometers					
1.2 Types of blood cells, methods of blood cell counting- microscopic method, automatic optical method, electrical conductivity method, coulter counter					
2 PHYSIOLOGICAL INSTRUMENTATION			18	12	**CO2**
2.1 Origin of bioelectric signals, recording electrodes, electrode tissue interface, polarization, skin contact impedance, motion artifacts. Block diagram of a typical biopotential recording system					
2.2 Block diagram of Electrocardiogram system, ECG leads, effects of artefacts on ECG recordings					
2.3 Electroencephelogram (EEG)-Block diagram, electrode placement					
2.4 Electromyography(EMG)-generation of EMG signals					
2.5 Evoked response potentials					
2.6 Blood pressure , blood pressure measurement using korotkoff's method (sphygmomanometer), Invasive measurement of blood pressure					
2.7 Measurement of Oxygen in the Blood, working of Pulse Oximeter					

3 PULMONARY FUNCTION MEASUREMENTS	12	04	**CO3**
3.1 Respiratory volumes and capacities			
3.2 Spirometry and its applications, Working of water seal spirometer, wedge spirometer and Fleisch- pneumotachometer			
3.3 Measurement of volume- flow volume curve			
4 MEDICAL IMAGING FUNDAMENTALS	21	12	**CO4**
4.1 Basics of Diagnostic Radiology, Nature and properties of x-rays, production of x-rays, stationary anode tube, Rotating Anode tube, x-ray machine, collimators & grids, x-ray films, x-ray Image intensifier			
4.2 Principle of computed tomography			
4.3 Principles of Magnetic resonance imaging (MRI) systems, Basic NMR components, Biological effects of NMR imaging, advantages of NMR imaging system.			
4.4 Diagnostic ultrasound-nature of ultrasound, ultrasound generators, interaction of ultrasound with matter, Pulse-Echo display modes in ultrasonic imaging(A-mode, B-mode and M-mode), Components of an ultrasound System (Block diagram level), Scanning probes (working of linear array and curved array transducer), Principle and Applications (listing only) of Doppler ultrasound, Principle of Echocardiography			
5 NUCLEAR MEDICINE	12	12	**CO4**
5.1 Radioactivity, radioactive decay law, interaction of radiation with matter			
5.2 Working of Scintillation detectors and Gamma Camera			
5.3 Principles and applications of SPECT and PET			
5.4 Radiation hazards and prevention, biological effects of radiation Exposure			
Total	**75**	**48**	-

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Clinical laboratory instruments	08	12
2	Physiological instrumentation	12	18
3	Pulmonary function measurements	04	12
4	Medical imaging fundamentals	12	21
5	Nuclear medicine	12	12
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Blood pressure measurement using a sphygmomanometer	
2	Study of ECG signal measurement	
3.	Study of patient monitoring system	
4.	Study of x-ray machine	
5.	Study of CT-scanner	
6.	Study of MRI scanner	
7.	Study of Sonography machine	
8.	Field visit to a hospital to study hospital layout, patient monitoring system, x-ray machines, CT-scanners, MRI scanners, pathlab, etc.	
9.	Field visit to an occupational health centre to study pulmonary function measurements	
	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.S. Kandpur	Handbook of biomedical instrumentation	McGraw Hill
2	Leslie Cromwell	Biomedical instrumentation and measurements	
3	John webster	Medical Instrumentation	John Wiley and sons
4	Satish K Bhargava	Step by Step: Ultrasound	
5	Sandra L. Hagen-Ansert	Textbook of diagnostic sonography	

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	D. Jennings, A. Flint, B.C.H. Turton and L.D.M. Nokes	Introduction to Medical Electronics Applications	Edward Arnold,
2	Ramesh Chandra	Introductory Physics of Nuclear Medicine	Lea & Febiger
3	Harry E Thomas	Handbook of biomedical instrument and measurement	Prentice Hall

(EX612) Autonomous Robots

1. AIM

Robotics is a fast –Growing field whose definition has been evolving over time, along with the field itself. Other than industrial applications, Robots are increasingly being used in newer field of application like medicine, space, exploration, and hazardous environment, military and domestic use. There is huge demand for innovation in autonomous robots in new areas like virtual reality, cars, personal care for disabled people. Robots are likely to be common basic necessity as human try to survive in a harsher future with security treats, depleted natural recourses and global climatic changes

2. COURSE OBJECTIVES / RATIONALE:

- To introduce students to Arduino Interactive Development IDE
- To enable them to understand the working and various types of Arduino board
- To help them build innovative projects using Arduino and IOT
- To introduce students to Internet of Things

3. PRE-REQUISITES:

Students should know

- programming concepts
- processing unit

4. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX612) Autonomous Robots	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the concept of Arduino processor and IOT
2. Apply the basic protocol and working principle of interfacing Modules.
3. Analyze various application program for wide range of Arduino processors
4. Design, debug and troubleshoot Arduino/IOT based project

6. Mapping Course Outcomes with Program Outcomes

Relationship : 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentn&	Engg. Practices for Society,Sustainability &	Project Management	Life - long Learning
CO1	3	2	1	0	0	0	2
CO2	2	3	2	1	2	0	3
CO3	0	3	3	2	3	0	3
CO4	0	3	3	3	3	3	3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**		
Unit			**M**	**TH**	**CO**
1 Autonomous Robotics					
1.1 definition of Robot, industrial Robot, Autonomous Robot, Applications 1.2 Autonomous Robot Types: wheeled and Legged, types of Stability: dynamic and Static 1.3 Control Components of AR: wired control, IR control, Radio Control, ZigBee 1.4 Sensor Navigation: Bump Switch, IR Sensor, Ultrasonic Range Finder, Accelerometer, GPS module, GPRS module 1.5 Block Diagram and Working Principle of Servo Motor and DC motor			18	12	CO1 CO2

2 Introduction to Arduino Programming 2.1 Block diagram, input and output pins of Arduino Uno development Board 2.2 Basic Commands of Arduino Programming Void Setup (), Void Loop(), pinMode(), 2.3 basic Commands for Serial Communication, analog Input/Output, Digital Input/output, delay commands	14	8	**CO3**
3 Sensor module interfacing with Arduino Uno (interfacing diagram and Arduino sketch for the following) 3.1 motion detector: tilt sensor, PIR 3.2 light detector :LDR 3.3 Distance Measurement Ultrasonic Sensor,IR sensor 3.4 Vibration detector: Piezo sensor 3.5 sound detector: Microphone 3.6 Temperature Sensor: LM35 3.7 Rotary Encoder 3.8 GPS ***[Note: Knowledge of interfacing any of above Sensor module with Arduino is of LEVEL 2 and writing Arduino sketch for such interfacing is of LEVEL3]***	18	12	**CO2, CO3**
4 Motor control with Arduino Uno (interfacing diagram and Arduino sketch for the following) 4.1 controlling position of servo motor 4.2 Controlling direction of DC motor using transistor H-bridge 4.3 Controlling direction of DC motor using IC: Movements for two wheeled Robot: move forward, move back ward, stop, move left, move righ ***(LEVEL 3)***	13	8	**CO2, CO3, CO4**
5 Internet Of Things (IOT) 5.1 Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models, IOT Module ***(LEVEL 1)*** 5.2 interfacing IOT module to Arduino Board ***(LEVEL 2)*** 5.3 Arduino based IOT Applications ***(LEVEL 4)***	12	8	CO1, CO2, CO3, CO4
Total	**75**	**48**	-

8. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**Autonomous Robotics**	12	18
2	**Introduction to Arduino Programming**	8	14
3	**Sensor module interfacing with Arduino Uno**	12	18
4	**Motor control with Arduino Uno**	8	13
5	**Internet of Things (IOT)**	8	12
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Interfacing and Programming of Arduino with motion detector: tilt sensor, PIR, Gyroscope, Accelerometer (any one)	2
2	Interfacing and Programming of Arduino with LDR	2
3	Interfacing and Programming of Arduino with ultrasonic Sensor/IR sensor	2
4	Interfacing and Programming of Arduino with Piezo Sensor	2
5	Interfacing and Programming of Arduino with microphone	2
6	Interfacing and Programming of Arduino with LM35	2
7	Interfacing and Programming of Arduino with servo motor	2
8	Interfacing and Programming of Arduino with DC motor	2
9	Programming Arduino for two wheeled Robot interfaced to Arduino for following movement like Move forward, Move back ward, stop, move left, move right	4
10	Mini Projects: Line Follower, obstacle Avoider, etc.	5
	Total	25 marks

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Massimo Banzi	Getting started with Arduino	Second Edition, O'reilly
2	Maja J. Mataric	Robotics Primer	Latest
3	Brian Evans	Beginning Arduino Programming	A Press Publishers, Recent Edition
4	Vijay Madisetti, Arshdeep Bahga,	"Internet of Things: A Hands-On Approach"	Recent edition

SEMESTER VI

(EX601) Digital Communication Techniques

1.AIM

1. To introduce students to Digital Communication methods and techniques used in Telecommunication.
2. To introduce students to the working of electronic telephone exchange.

2. COURSE OBJECTIVES:

The students will able to:

1. To understand various digital communication techniques.
2. To understand the working of an Electronic telephone exchange.

3. PRE-REQUISITES:

Students should know

1. Basic Communication Engineering.
2. Working of Linear ICs.

4. TEACHING AND EXAMINATION SCHEME

Semester	VI								
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(EX601) Digital Communication Techniques		L	T	P	C	TH	TM	TW	ORALS	
		3	-	-	3	75	25	-	-	100

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Describe the working of an Electronic telephone exchange.
2. Differentiate between TD and FD multiplexing techniques.
3. Analyze the working of pulse modulation circuits used in telecommunication field.
4. Analyze the working of Digital modulation Systems used in telecommunication field.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn& Testing	Engg. Practices for Society,Sustainability & Environment	Project Management	Life -long Learning
CO1	2	0	1	0	0	2	3
CO2	2	2	1	1	0	2	3
CO3	2	1	2	3	0	2	3
CO4	2	1	1	2	0	2	3

Relationship : Low-1 Medium-2 High-3

Mapping Course Outcomes with Program Specific Outcomes

	PSO1	PSO2
CO1	3	1
CO2	3	1
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives		
Unit		**M**	**Thr**	**CO**
1 Pulse Modulation Systems (No Mathematical derivations)		**23**	**14**	**CO3**
1.1 Introduction to Digital Communications Shannon Hartley Law - Equation representing the law, Relation between channel capacity and noise. Sampling Theorem - Statement and its significance. Working of sample and Hold circuit using an op-amp				
1.2 Pulse Amplitude Modulation Definition, Block diagram and typical circuit for generation of PAM. Types of PAM - Waveform for Natural, flat-top, single & double polarity PAM. Block diagram and typical circuit for demodulation of PAM. Aliasing effect and aperture effect in PAM, Anti-aliasing filter.				
1.3 Pulse Time Modulation Definition of PWM and PPM. Generation of PTM - Indirect and direct methods, Waveform for starting edge fixed, trailing edge fixed and centre fixed PWM and PPM. Modulator circuits for PWM and PPM using IC 555. Demodulation of PTM - Waveform for demodulation of PWM and PPM. Demodulator circuits for PWM and PPM using op-amp.				
2 Pulse Communication Systems(No Mathematical derivations)		**15**	**10**	**CO3**
2.1 Pulse Code Modulation Block Diagram of PCM Transmitter. Quantization, Quantization error, Companding. Block Diagram of PCM Receiver.				
2.2 Differential Pulse Code Modulation Block Diagram of DPCM Transmitter and Receiver.				
2.3 Delta Modulation Block Diagram of DM Transmitter and Receiver. Limitations of DM- Slope Overload and granular noise.				
2.4 Adaptive Delta Modulation Block Diagram of ADM Transmitter and Receiver.				

3 Digital Modulation Techniques	**14**	**09**	**CO4**
3.1 Amplitude Shift Keying Definition, waveform, block diagram for generation and detection of ASK			
3.2 Frequency Shift Keying Definition, waveform, block diagram for generation and detection of FSK Types of FSK- coherent and non-coherent type.			
3.3 Phase Shift Keying Basic Principle, waveform, Phasor diagram and block diagram for generation and detection of Binary PSK and Quadrature PSK.			
4 Multiple access techniques in Pulse communication.	**05**	**03**	**CO2**
4.1 Time Division Multiplexing Block diagram for TDM – PAM system.			
4.2 Frequency Division Multiplexing Block diagram for FDM – PAM system.			
4.3 Comparison of FDM and TDM Advantages and disadvantages of both TDM and FDM			
5 Electronic Telephone Exchange	**18**	**12**	**CO1**
5.1 Introduction to Electronic Exchange Basic terms related to an exchange. Basics of a switching system and classification of switching systems Elements of a Switching system - Block diagram and working			
5.2 Electronic Space Division Switching Concept of Stored Program Control Centralized SPC - Typical block diagram, Single and dual processor systems, Three modes of operation(Standby, Synchronous dupiex and Load sharing) Distributed SPC - Level 3, Level2 and Level 1 processing			
5.3 Time Division Switching Time Division Space Switching: Concept and three types - Input controlled, output controlled and memory controlled Time Division Time Switching Concept and methods of control (listing and definition only)			
5.4 Call processing Steps involved in call processing sequence			
Total	**75**	**48**	

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Pulse Modulation Systems	14	23
2	Pulse Communication Systems	10	15
3	Digital Modulation Techniques	09	14
4	Multiple access techniques in Pulse communication	03	05
5	Electronic Telephone Exchange	12	18
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical (Perform any 8)	Marks
1.	Generation and Demodulation of PAM using trainer kits/typical circuits	
2.	Generation and Demodulation of PWM using trainer kits/typical circuits	
3.	Generation and Demodulation of PPM using trainer kits/typical circuits	
4.	Generation and Demodulation of PCM & DPCM using trainer kits/typical circuits	
5.	Generation and Demodulation of DM & ADM using trainer kits/typical circuits	
6.	Generation and Demodulation of ASK using trainer kits/typical circuits	
7.	Generation and Demodulation of FSK using trainer kits/typical circuits	
8.	Generation and Demodulation of BPSK using trainer kits/typical circuits	
9.	Generation and Demodulation of TDM - PAM using trainer kits/typical circuits	
10	Generation and Demodulation of FDM - PAM using trainer kits/typical circuits	
	Total	**25**
	Class room Assignments	
	At least 2 assignments	

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	RP Singh& SD Sapre	Communication system 2nd edition	Tata McGraw-hill publishing
2	ThiagarajanViswanathan	Telecommunication Switching Systems and Networks	Prentice Hall India

(CC 502) ESSENTIALS OF ENTREPRENEURSHIP DEVELOPMENT

1. COURSE OBJECTIVES:

Today Entrepreneurship is given importance by the government to bring the youth of our country to overcome the problem of unemployment and bring them in the main stream of global business to strengthen Indian economy by Make in India philosophy. Government has announced various financial schemes for young youth and women to support them for setting up an enterprise. To fulfill this, youth are to be prepared for setting an enterprise. The students undergoing this course will be able to develop entrepreneurial traits and confidence within themselves and choose entrepreneurship as a career to brighten their future.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	-	-	PR/OR	TW	
(CC502) ESSENTIALS OF ENTREPRE-NEURSHIP DEVELOPMENT	-	-	2	2	-	-	-	25	25

3. COURSE OUTCOMES:

CC502.CO1: Recognize the type of entrepreneur and enterprises.

CC502.CO2: Describe basic financial & legal aspects of business.

CC502.CO3: Conceptualize a business idea.

CC502.CO4: Develop the project report for new enterprise.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	1	0	0	0	2	3	2	1	2
CO2	2	0	0	0	0	3	2	1	2
CO3	0	1	2	0	0	0	2	1	2
CO4	3	2	2	0	2	0	2	2	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS

M=Marks	Phr= Practical hours	CO – Course Outcomes			
Unit			M	Phr	CO
1. INDIAN BUSINESS ENVIRONMENT					
a. Introduction to Entrepreneurship Development (EDP) b. Brief details of following terms : India GDP, IIP data, Govt. business policies, Environmental policy, Effects of global policies, Anti-dumping duty, Effects of national budget on start-ups and businesses.				4	CO1
2. VARIOUS TYPES OF BUSINESSES					
2.1Brief details of following businesses: Cyclical and Non-cyclical business, Seasonal and Non-seasonal business, Monopoly and Duopoly business, Concept base business, Commodity and Non-commodity business, Asset light business, b2b and b2c business, 2.2 Difference between Subsidiary and Associate company				6	CO1
3. SELECTION OF BUSINESS					
3.1Types of Sectors, Steps in sectoral analysis, factors to pick up a Sector, Data collection of Sectors. 3.2 Terminologies: Sector rotation, Gross block addition. 3.3 Steps to read Outline of balance sheet, profit-loss statement, cash flow statement. 3.4 Data analysis on following factors: i) Market growth ii) Sector consolidation. 3.5 Brief details of following: Profitability, Effect of Govt policies, Pricing power, Debt, working capital, return on capital employed, Cash conversion cycle, Companies with peer group.				4	CO1 CO2

4 SETTING UP OF BUSINESS			
4.1Various Govt depts. and organization supporting business ideas. 4.2 Methods to raise capital (difference between Banks and NBFC). 4.3Factors in machine, material, manpower procurement, advertising, product specialty, 4.4 Micro, Small and Medium Enterprises (MSME), Govt support for MSME, Private Limited and Public Limited Enterprises, 4.5 Goods & Service Tax(GST), Registering for GST and go ahead, 4.6Various income tax slabs, 4.7Application for various utility connections, various permissions required to set up business.		10	CO1 CO2 CO3
5. EXPANSION OF BUSINESS			
5.1Types of investors: angel investors, venture capitalist, promoters. 5.2Terminology: 5.2.1EPS, EPS growth, P/E ratio, 5.2.2Market capital, paid up capital, authorized share capital, 5.2.3Corporate governance, Related party transactions, business insiders, assets and inventory turnover, break even analysis, brown field and green field expansion. 5.3 Listing start up on stock exchange &Govt support. 5.4 Business report writing, Reading of Red Herring prospectus		8	CO1 CO2 CO3 CO4
Total		32	

6. COURSE DELIVERY:

Videos / Lectures/ Practicals /Expert lectures / Industry visits/ documentaries/movies

Suggested expert talk on

- various Govt schemes
- GST
- Financial literacy
- Any relevant topic

7. SPECIFICATION TABLE FOR PRACTICALS

Unit No.	Topic	Teaching Hours/ Semester
1	**Indian business environment**	**4**
2	**various types of businesses**	**6**
3	**selection of business**	**9**
4	**Setting up of business**	**9**
5	**Expansion of business**	**4**
	TOTAL	**32**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICAL HOURS

No	Classroom Assignments	Marks
1.	Prepare a Case Study on leading enterprise or small-scale unit	6
2.	Prepare a report on various government schemes for startup.	4
3.	Prepare SWOT analysis for a new business idea.	5
4.	Prepare Project Report for a new business idea.	10
	OR	
1.	Preparing a project report on basis of draft Red Herring prospectus	25

9. LEARNING RESOURCES

S.No.	Author	Title of Books	Publisher
1.	Sharadjawadekar, shobhadodlani,	Business entrepreneurship	Suvicharprakashanmandalpune,
2.	S.S. Khanna	Entrepreneurship development	S. Chand & Co. Ltd, New Delhi,
3.	Vasant Desai	Management of small-Scale Industry in India	Himalaya Publishing House
4.	DilipSarwate	Entrepreneurial development Concepts and practices	Everest Publication House, Pune
5.	CB Gupta and P Srinivasan	Entrepreneurship Development	S. Chand and Sons, New Delhi

https://ncert.nic.in/ncerts/l/leac203.pdf
https://ncert.nic.in/ncerts/l/leac204.pdf
https://www.wirc-icai.org/images/publication/IND-AS-BOOK.pdf
https://cma.org.sa/en/Awareness/Publications/booklets/Booklet_4.pdf
https://www.icsi.edu/media/portals/25/IPO.pdf
https://old.mu.ac.in/wp-content/uploads/2017/01/FINANCIAL-STATEMENT-ANALYSIS.pdf
https://ncert.nic.in/textbook/pdf/jess202.pdf
https://dea.gov.in/sites/default/files/
https://dea.gov.in/monthly-economic-report-table
https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/0HSIF_F.PDF
https://ncert.nic.in/textbook/pdf/lebs202.pdf
https://www.oecd.org/industry/inv/investmentfordevelopment/33806126.pdf
https://www.youtube.com/watch?v=NV8Ew6PeQhY
file:///C:/Users/User/Downloads/1-s2.0-S0970389617304664-main.pdf

(EX 602) Industrial Electronics

1. AIM

To explore different areas of process controls of the industry where electronic circuits can replace the conventional methods, for efficiency, ease of method and economic advantages.

2. COURSE OBJECTIVES:

The students will able to:
1. Understand industrial requirements for controlling different processes
2. Applications of different components and circuits using these components.

3. PRE-REQUISITES:

Students should know
1. Working of thyristors, Timer IC 555
2. Amplifiers and Oscillator circuits

4. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
(EX602) Industrial Electronics	3	-	2	5	75	25	25	-	125

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
1. Explain different industrial, ultrasonics , high frequency heating process control circuits
2. Explain use of electronics switches to industrial circuits and in speed control of motors
3 Apply knowledge of Timers for different industrial circuits and resources used in control engineering
4. Analyze output for different variables.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	**3**	**2**	**3**	**2**	**3**	**3**	**3**
CO2	3	3	2	2	3	2	3
CO3	3	3	2	3	3	2	3
CO4	3	3	3	2	2	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	3

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	**L - Levels**

Unit	**M**	**Thr**	**CO**
1 Industrial circuits	**22**	**13**	**CO 1,2,3, 4**
1.1 Circuits using thyristors : Burglar alarm, smoke detector, Temperature controller using thermostat,, battery charger, Emergency light, thermistor controlled heater, power flasher,automatic Street light control using LDR			
1.2 Ic 555 Timer : Design Astable mutivibrator for specific Ton, Toff or frequency, Design of monostable multivibrator for specific pulse width			
1.3 circuits Using 555 Timer : Bistable Multivibrator, Water level indicator, water level controller, photocounter			
1.4 Cell phone jammer using tuned oscillator circuit			
1 **Ultrasonics**	09	06	**CO 1,2,3**
2.1 Wavelength and velocity in air, liquid and solid.			
2.2 Piezoelectric generation of ultrasonic waves			
2.3 Application : Flaw detection, Flow meter List of applications in Medical field			
2.3 Ultrasound welding : Principle, advantages, disadvantages			

2 **High Frequency heating**	14	9	**CO 1,2**
3.1 Induction heating: principle, Features, skin effect, advantages, disadvantages, List of applications in industry Applications in detail: surface hardening , brazing			
3.2 Dielectric heating : principle, features, generation, advantages, disadvantages, Enlist applications			
3.3 comparison : dielectric and induction heating			
4 Electric motor speed control	15	10	**CO 1,2,3, 4**
4.1 DC motor :Operating principle, types, Dc shunt motor :concept of back emf, equivalent diagram, simple numerical to calculate back emf, relationship between speed, voltage, current , torque, characteristics of shunt motor : torque, current, speed.			
4.2 Numerical on speed calculations for variable flux, torque, current , terminal voltage.			
4.2 Speed control of Dc motor using thyristors: advantages, speed control using full wave SCR. Speed control and regulation by tachometer method: for increased and decreased load.			
4.4 Simple calculations between speed, voltage and firing angle.			
4.3 Speed control of AC motors : Single phase AC series motor speed control using SCR			
5 Process control Engg	15	10	**CO 1,2,3**
5.1 Process control : Basic objective, Simple block diagram Pressure control using Pneumatic amplifier: Definition of Pneumatic amplifier, basic components, block diagram and pressure control Liquid flow control using flow control valve Mechanical movement control using Solenoid coil			
5.2 concept of servomechanism, block diagram DC servo speed control(separately excited) :Field controlled method: advantages and disadvantages armature controlled method, comparison between above two methods Speed control of AC servo motor			
5.3 Stepper motor : Basic principle of operation of 4 position Synchros : definition Synchro Transmitter and Receiver			
Total	**75**	**48**	-

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Industrial circuits	13	22
2	Ultrasonic	06	09
3	High Frequency heating	09	14
4	Electric motor speed control	10	15
5	Process control Engineering	10	15
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS (Any 8)

No	Practical	Marks
1.	Assemble and Test burglar alarm	
2	Assemble and test smoke detector	
3	Assemble test power flasher	
4	Assemble and test photocounter using 555	
5	Assemble and test water level indicator	
6	Assemble and test water level controller	
7	Test Induction heating	
8	Test dielectric heating	
9	Test motor speed control, using thyristor	
10	Test synchro transmitter and receiver control	
11	Flaw detection using ultrasound waves	
	TOTAL	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Rao, Sutrave	Industrial Electronics	Tata McGraw Hill
2	S.K Bhattacharya, S. Chatterjee	Industrial Electronics and control	Tata McGraw Hill
3	Curties Johnson	Process control Instrumentation	Pearson Education
4	B.L. Theraja	Electrical Engg	S. Chand

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Chute and Chute	Industrial Electronics	Tata McGraw Hill
2	J.D. Ryder	Electronics Engg	Prentice Hall India
3	Bimbhra P.S.	Power electronics	Khanna publishers

(EX603) PROJECT

1. AIM

This is intended to integrate several skills and competencies which have been developed in the students during his/her course of study and gets manifested through this project.

2. COURSE OBJECTIVES:

The students will able to:

i. Cultivate the systematic methodology for problem solving using acquired technical knowledge & skills, and to enhance the generic skills & professional skills
ii. Develop problem solving, analysis, synthesis and evaluation skills.
iii. Encourage teamwork.
iv. Improve students' communication skills through project reports and presentations of their work.

3. PRE-REQUISITES:

i. Basic Engineering Skills
ii. Electronics & allied Courses

4. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
(EX 603) PROJECT	-	-	06	06	-	-	100	50	150

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Identify, analyze & define the problem
2. Apply acquired knowledge of engineering to execute solution
3. Develop leadership skills & teamwork to design & execute hardware & related software
4. Compile the relevant data in the form of a report and defend the project

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentatin & Testing	Engg. Practices for Society,Sustain ability & Environment	Project Management	Life -long Learning
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	2	-	-	-	-	3	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

The following are some of the suggested activities which the student has to undertake (which may slightly differ depending on the project chosen) during the project work. In so doing some process related and project related skills need to be evaluated.

- Selection/Identification of project Work by market survey/industrial survey.
- Project Proposal
- Market survey for product sales & economic viability of product (for entrepreneurship)
- Costing of the project/product i) Capital costs ii) Material & production cost
- Design of project to obtain desired output.
- Procurement of components & equivalents.
- Working skill of fabrication.
- Testing of product
  - i. Drafting
  - ii. Sketching
  - iii. Layout
  - iv. Presentation

AUDIT COURSE

(AC102) INDIAN CONSTITUTION

1. COURSE OBJECTIVES:

As a proud citizen of this country every student must be aware about the Indian Constitution to appreciate the provisions available for the people of this biggest democracy in Indian Constitution so that the youth of this country plays active role in development of the country by participating in the formation of sensitive and proactive Government at national and state level.This course intends to make students aware about various constituents of the Indian Constitution.

2. TEACHING AND EXAMINATION SCHEME

Semester	VI									
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(AC102) INDIAN CONSTITUTION		L	T	P	C	TH	TM	TW	PR/OR	
		2	-	-	2	-	-	-	-	-

3. Course Content

Unit 1 – The Constitution - Introduction • The History of the Making of the Indian Constitution • Preamble and the Basic Structure, and its interpretation • Fundamental Rights and Duties and their interpretation • State Policy Principles
Unit 2 – Union Government • Structure of the Indian Union • President – Role and Power • Prime Minister and Council of Ministers • Lok Sabha and Rajya Sabha
Unit 3 – State Government • Governor – Role and Power • Chief Minister and Council of Ministers • State Secretariat
Unit 4 – Local Administration • District Administration • Municipal Corporation • Zila Panchayat
Unit 5 – Election Commission • Role and Functioning • Chief Election Commissioner • State Election Commission

4. Suggested Learning Resources:

Title of Book Author Publication
1. Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi,2008
2. The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3. Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Third 2018 edition

5. Suggested Software/Learning Websites:

a. https://www.constitution.org/cons/india/const.html
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-ofindia/

ELECTIVES – SEMESTER VI

(EX619) Data Communications

1. AIM

1. To introduce students to Data Communication through a network.

2. COURSE OBJECTIVES:

The students will able to:

1. To understand data flow through a computer network.

3. PRE-REQUISITES:

Students should know

1. Analog and Digital Communication Techniques.

4. TEACHING AND EXAMINATION SCHEME

Semester	VI									
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(EX619)		L	T	P	C	TH	TM	TW	PR/OR	
Data Communications		3	-	2	5	75	25	25	25	150

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Describe various Protocols for Data link layer.
2. Identify Components of computer communication and types of Computer Networks.
3. Analyze functions of various layers in the OSI model of a computer Network.
4. Interpret various errors and their control in a network.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopme nt of	Engg. Tools, Experime ntatn&	Engg. Practices for Society,Su stainabilit y&	Project Managem ent	Life -long Learning
CO1	2	1	0	1	0	2	3
CO2	2	1	0	1	0	2	3
CO3	2	1	0	1	0	2	3
CO4	2	2	0	1	0	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			M	Thr	CO
1 Introduction to Data Communication and Computer Networks			15	10	CO2
1.1 Components of Data Communication system **Five major elements of the system and their meaning.**					
1.2 Types of Data **Various types of data(Picture, Video, Audio etc.) and various types of data signals (Analog and digital).**					
1.3 Direction of Data Flow **Simplex, half and full Duplex.**					
1.4Modulation techniques used **List of Analog and Digital modulation techniques, Quadrature Phase Shift keying and QAM system working.**					
1.5Type of Connection **Point to point and multipoint.**					
1.6Topologies **Mesh, Star. Bus, and Ring topologies and their comparisons.**					
1.7Categories of Networks **Brief description of LAN, WAN, MAN.**					
1.8 Protocols and Standards **Meaning and key elements of protocol, Important standard organizations.**					

2 Network Layers (No Mathematical treatment)	10	07	CO3
2.1 Internet Model **Organization and Functions of Physical, Data link, Network, Transport and Application layers.**			
2.2 OSI Model **Functions of Session and Presentation layers, Data flow through all layers.**			
2.3 Data Transmission Modes **Parallel, Serial, Synchronous and Asynchronous.**			
3 Error Detection and Correction	12	06	CO4
3.1 Types of Errors **Single bit error, Burst Error.**			
3.2 Detection of Error **Redundancy, Parity Check, CRC, Checksum.**			
3.3 Correction of Error **Forward Error Correction, Hamming Code, Burst Error correction.**			
4 Data Link Control & Protocol	27	18	CO1
4.1 Flow and Error Control **Flow and Error control meaning and Operation of error control mechanisms - Stop-and-Wait ARQ, Go-Back-N ARQ, and Selective Repeat ARQ.**			
4.2 Data Link Protocol **HDLC Protocol- Types of frames, Frame formats of I frame, S frame and U frame, Data transparency.**			
4.3 Point – to – Point Protocol **Meaning, services provided, frame format and transition states.**			
4.4 Multiple Access Protocol **Random Access meaning, CSMA/CD procedure and CSMA/CA procedure.** **Controlled Access meaning and methods.**			
5 Local Area Networks	10	07	CO2
5.1 Wired LAN/ Ethernet **Main features of Traditional Ethernet, Fast Ethernet and Gigabit Ethernet.**			
5.2 Wireless LAN **Main features of IEEE 802.11 and Bluetooth.**			
5.3 Connecting Devices, backbone Networks and VLANs **Repeaters, Hubs and Bridges, Bus and Star as backbone networks and main features of Virtual LANs.**			
Total	75	**48**	

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction to Data Communication and Computer Networks	10	15
2	Network Layers	07	10
3	Error Detection and Correction	06	12
4	Data Link Control & Protocol	18	27
5	Local Area Networks	07	11
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	**Study of different types of transmission media.**	
2.	**Study and analysis of QPSK Modulation.**	
3.	**Study and analysis of QAM Modulation.**	
4	**Study of Serial Interface using RS-232.**	
5.	**Study of Pc to Pc or PC to Printer Communication using parallel port.**	
6.	**Study of LAN using Bus topology.**	
7.	**Study of LAN using Star topology.**	
8.	**To study/configure a MODEM for Computer to Internet connection**	
9.	**To configure a hub/switch**	
10.	**Study interconnection of cables for data communication.**	
11.	**Study Pc to PC communication using Ethernet LAN**	
12.	**Study Pc to PC communication using Wireless LAN**	
	Total	25
No	Class room Assignments	Marks
1	At least 02 assignments on relevant topics	
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Behrouz A Forouzan	Data Communications and Networks 3rd Edition	Tata McGraw-hill publishing

(EX 616) ROBOTICS

1. AIM

To develop required skills in the students so that they are able to acquire the following competency:
1. Operate and maintain different types of robots.

2. COURSE OBJECTIVES:

Nowadays industries demand continuous and fine quality work in different processes of industries. All process is generally done by humans and as we know humans are not able to give same quantity and quality of work with respect to time, environment and complexity of the work. To get quality and quantity of work in toughest environment or the environment which is not suitable for the humans to work, industries demand for robots and its operator. Operators which operate this robot need some basic knowledge of robotics. To fulfil the demand of industries and advancement in technology it is necessary for the electronic engineers to have knowledge and skill in robotics.

The students will able to:
1. Explain different components of robot & compare various types of Robot.
2. Study the working of various robot controller & Differentiate between various robot controllers.
3. Explain the kinematics & vision system of Robot.
4. Compare the uses of various sensors & warning system & appreciate the application of robot s in various industries.

3. PRE-REQUISITES:

Students should know
1. Basics of C programming.
2. Embedded systems.

4. TEACHING AND EXAMINATION SCHEME

Semester	VI									
(EX 616) ROBOTICS		Periods/Week (in hours)			Total Credits	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
		3	-	2	5	75	25	25	25	150

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
CO1. Define and select right parameters for robot for given application.
CO2. Distinguish between various robot controller & Actuators.
CO3. Maintain the different types of robot sensors.
CO4. Operate the robot through software and trouble-shoot minor problems.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentn&	Engg. Practices for Society,Sustainability &	Project Management	Life -long Learning
CO1	3	3	3	3	0	2	0
CO2	2	1	1	2	0	1	0
CO3	3	2	3	3	1	2	2
CO4	3	3	3	3	0	2	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	1
CO2	2	0
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	
Unit	**M**	**Thr**	**CO**
1. ELEMENTS OF ROBOT	**18**	**12**	**CO 1.3**
1.1 Basic Concepts in (Fundamentals of) robotics: Introduction, Definition, Automation and robotics, Generations of Robots, Robot applications.			
1.2 Different classifications of robot: By application (Material handling, operations, Assembly, Inspection), by coordinate system (Cartesian, Cylindrical, Spherical, Articulated, SCARA), by actuation (drive) system (Hydraulic, Electric, Pneumatic), by control system (Limited sequence, playback with point to point control, playback with continuous control, Intelligent Robots) and by programming method (Lead-through, Textual).			
1.3 Robot anatomy: Links and joints, Joint notation. Degree of Freedom. Robot resolution, accuracy and repeatability. Concept of workspace.			
2. ROBOT CONTROLLER AND ACTUATION SYSTEMS	**15**	**10**	**CO 1,2,4**
2.1 Robot controller: open and closed loop control systems (explanation with block diagram, advantages & comparison) Controllers: (On-off, Proportional, Integral, Proportional plus Integral, Proportional plus derivative, Proportional plus integral plus			

derivative- explain in brief)			
2.2 Robot Actuation and feed-back components Position Sensors (Potentiometers, encoders), Actuators (DC servo motors, Stepper motors, Pneumatic and Hydraulic), Velocity Sensors, Power Transmission Systems (Gears, Power Screws)			
3. ROBOT EFFECTORS, SENSORS & MACHINE VISION	**15**	**10**	**CO 2,4**
3.1 Robot End Effectors: Grippers and Tools. Basic Definition and operation: Mechanical grippers, Vacuum cups, Magnetic grippers. Tools as end effectors.			
3.2 Transducers and Sensors Desirable features of sensors. Basic working principle:- Tactile sensors (Touch, Force), Proximity and Range sensors (Light and Ultrasonic) Uses/ Applications of sensors in Robotics.			
3.2 Machine Vision Introduction to Machine Vision (Sensing and digitizing Image, Image processing and analysis, Application) (block diagram and explanation only) Robotic applications of machine vision			
4. ROBOT PROGRAMMING	**12**	**6**	**CO 4**
4.1 Robot programming Lead-through (Powered & Manual) and Textual robot languages. Robot Programme as a Path in Space, Motion Interpolation, WAIT, SIGNAL and DELAY Commands, Capabilities and Limitations of Lead through Methods, Robot Language Structure. Comparison of Lead-through (Powered & Manual) v/s Textual robot languages			
5. ROBOTICS APPLICATIONS, MAINTAINANCE & SAFETY	**15**	**10**	**CO 3,4**
5.1 Robotics Applications Material Transfer (Pick and place) Process operations (Arc wielding) Assembly Application (Peg in hole) Inspection Application (Sensor/Vision based inspection) Non Industrial Application (Health Care, Research and Exploration etc.) Robot maintenance: Need and Types. General Safety Norms, aspects and precautions in robot handling.			
Total	**75**	**48**	**----**

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	ELEMENTS OF ROBOT	12	18
2	ROBOT CONTROLLER AND ACTUATION SYSTEMS	10	15
3	ROBOT EFFECTORS, SENSORS & MACHINE VISION	10	15
4	ROBOT PROGRAMMING	06	12
5	ROBOTICS APPLICATIONS, MAINTAINANCE & SAFETY	10	15
	Total	**48**	**75**

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Electronic Control of a DC Servo motor	
2.	Electronic Control of a Stepper motor	
3.	Electronic control of BLDC motor	
4.	Interfacing of proximity and range sensors to Arduino	
5.	Interfacing of Accelerometers and Gyroscopes sensors to Arduino	
6.	Interfacing of force sensors to Arduino	
7.	Programming a robot arm for straight line, circular and curved paths	
8.	Programming a robot arm for pick and place operation.	
	Total	25
No	**Class room Assignments**	**Marks**
1	Atleast 02 assignments	
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Mikkel P.Groover, Mite chell weiss, Rogern Negal and Nicholes G.Odress	Industrial Robotics Technology- Programming and Applications	Tata McGraw Hill
2	R.K.Mittal, I.J.Nagrath	Robotics and controls	Tata McGraw Hill
3	K.S. Fu, R. C. Gonzalez, C.S.G. Lee	Robotics: Control, Sensing, Vision and Intelligence	McGraw Hill

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Doughlaes R. Halcoojr	An Introduction to robotics	

Internet and Web Resources

S. No.	Author
1	*http://enggmechanical.blogspot.com/2010/06/classification-of-robot.html*

(EX 615)VHDL

1. AIM: To introduce hardware description language VHDL and its application in designing digital circuits and hardware in FPGAs

2. COURSE OBJECTIVES: Learn VHDL programming and use it to design and simulate different types of digital circuits and programmable logic devices and field programmable gate arrays..

The students will able to:

1. Learn VHDL programming.
2. Design and write codes for different digital circuits
3. Use VHDL for simulating the operation of digital hardware

3. PRE-REQUISITES: Students should know

1. Basic knowledge of c programming
2. Combinational and synchronous sequential circuits
3. Flip flops, registers and counters

4. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX 615) VHDL	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Develop basic programming skills in VHDL
2. Write/Develop VHDL codes for combinational and sequential digital circuits
3. Compile, debug and simulate VHDL codes for combinational and sequential digital circuits.
4. Design digital circuits and logic devices

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimenta in& Testing	Engg. Practices for Society,Sust ainability & Environmen t	Project Managemen t	Life -long Learning
CO1	2	2	3	1	0	2	3
CO2	2	3	3	2	0	2	3
CO3	2	3	1	3	0	2	3
CO4	2	3	3	2	2	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	2	2
CO4	3	3

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1.Overview of digital design with VHDL	**9**	**5**	**CO 1**
1.1 1.1 VHDL:-What is VHDL • Hardware abstraction • Why use VHDL • Shortcomings of VHDL steps in using VHDL for design Synthesis			
1.2 Hierarchical Modeling techniques- Top down and bottom up design methodology, difference between modules and instances (only definition)			
2. VHDL reference	15	9	**CO 1**
2.1 Documentation (comment line) • Data objects • Data object names • Data object values and numbers • Signal data objects • Bit and Bit vector types • STD_LOGIC and STD_LOGIC_VECTOR types • Signed and unsigned type • INTEGER type • CONSTANT data objects • VARIABLE data objects			

• Arrays Operators			
2.2 **VHDL design entity**-Entity declaration, Architecture, Package. writing simple VHDL code for a given logic function			
3 VHDL code for combinational circuits	21	14	**CO 2,3**
3.1 selected signal assignment- 4-to-1 mux			
3.2 conditional signal assignment-priority encoder, 4 bit comparator			
3.3 process statement-2-to-1 mux using if-then-else statement			
3.4 case statement- 2-to-4 binary decoder,BCD to 7 segment			
3.55 **VHDL code for:** • And,.or,nand,nor gates • 4 bit arithmetic adder,4 bit arithmetic subtractor			
4 Flip Flops, Registers	12	8	**CO 2,3**
4.1 **Circuit,timing diagram,graphical symbol and VHDL code of**:- gated D latch,D flip flop,T flip flop and JK flip flop			
4.2 **Circuit diagram and VHDL code of-** simple shift register and parallel-access shift register			
5 Synchronous Sequential circuits and logic devices	18	12	**CO 3,4**
5.1 Circuit diagram and timing diagram of-4-bit up counter,4-bit down counter,2-digit BCD counter.			
5.2 Moore type finite state machine-state diagram and VHDL code			
5.3 Mealy type finite state machine-state diagram and VHDL code.			
5.4 Programmable logic devices-PAL,PLA,CPLD,FPGA, applications of CPLD and FPGA			
Total	**75**	**48**	

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**Overview of digital design with VHDL**	5	9
2	**VHDL reference**	9	15
3	**VHDL code for combinational circuits**	14	21
4	**Flip Flops, Registers**	8	12
5	**Synchronous Sequential circuits**	12	18
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
	Design and simulate using -VHDL language	
1.	Design and implementation of Basic gates-AND,OR,NOT gates	
2	Design and implementation of 4-to-1 mux	
3	Design and implementation of 2-t0-4 Decoder	
4	Design and implementation of RS Flip Flop	
5	Design and implementation of JK Flip Flop	
6	Design and implementation of D Flip Flop	
7	Design and implementation of 4 bit up counter	
8	Design and implementation of shift register	
9	Design and implementation of logic devices	
		Marks
No	**Assignments**	
1	At-least 02 assignments	
2		
...		
No	**Tutorial Exercise**	**Marks**
1	NIL	
2		
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Stephen Brown and Vranesic	Fundamentals of Digital Logic with VHDL design	Tata McGraw Hill,2008, India, ISBN 978–0–07–352953–0
2	Samir Palnitkar	Verilog HDL: A Guide to Digital Design and Synthesis,	Prentice Hall ISBN: 0-13-044911-3 (downloadable)
3	Jayaram Bhaskar	A VHDL primer	PTR Prentice Hall

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Kevin Skahill and Cyress	VHDL for Programmable Logic	Pearson Education (downloadable)
2	Douglas Perry	VHDL:Programming by example	Tata McGraw Hill,2008, India, ISBN 978-0-07-049944-7

(EX 621) Digital Signal Processing

1. AIM:-To study signal representation in time and frequency domain, DFT, Z transform and design of digital filters.

2. COURSE OBJECTIVES: To learn different types of discrete signals, its classification and representation. Introduce Z transforms, DFT, FFT and study FIR and IIR filters.

The students will able to:
1.analyze given signal or system using tool such as Z transform and DFT
2.learn properties of signal and systems
3.process the signal to make it useful.

3. PRE-REQUISITES:
1. linear algebra,calculus and trigonometry
2. knowledge of complex numbers
3. programming knowledge
4. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX621) Digital Signal Processing	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand Fourier transform, Discrete Fourier Transform and Fast Fourier Transform with regards to DSP
2. Interpret, represent and process different types of digital signals and systems and their properties.
3 Make use of Z transform technique for ROC.
4. Ability to analyze DSP systems like FIR and IIR digital filters.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentatn&	Engg. Practices for Society,Sustainability &	Project Management	Life -long Learning
CO1	3	2	2	1	2	3	3
CO2	3	3	2	1	2	3	3
CO3	3	3	2	2	2	3	3
CO4	3	3	3	2	2	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**		
Unit			**M**	**Thr**	**CO**
1. Introduction to Digital Signal Processing			**6**	**5**	**CO 2**
1.1 Basic components of DSP system • Advantages of DSP • Digital Signal processors • Importance of Digital signal processing					
1.2 **Define**-signal, analog-signal, discrete-signal, continuous time signal, discrete time signal, digital signals, Quantization levels					
2. Discrete Time signals and Systems			24	15	**CO 2**
2.1 **Representation of Discrete Time signals**-Functional, Graphical					
2.2 **Define Standard discrete time signals**-Unit step sequence, Unit Ramp Sequence, Unit Impulse sequence, Sinusoidal sequence. Functional and graphical representation of the above-mentioned signals					
2.3 **Classification of Discrete time signals (only definition)** - Deterministic and nondeterministic signals, Periodic and Aperiodic Signals, Symmetric and antisymmetric signals, Causal and noncausal signals, Energy and power signals.(No problem solving)					

2.4 **Mathematical operations on Discrete time signals (with numerals)**-Scaling(Amplitude and time),Folding, shifting(right shift and left shift), addition and multiplication.			
2.5 Explain Discrete time system, LTI and Impulse response.			
2.6 **Classification of Discrete time signals (only definition)**-Static and dynamic systems, Time invariant and variant systems, Linear and non Linear,Causal and non causal,stable and unstable FIR and IIR, Recursive and nonrecursive 2.7 Discrete or linear Convolution and its procedure.			
3. Z transforms	18	**12**	**CO 2,3**
3.1 Define Z-Transform, one-sided and two-sided Z-transform, Inverse Z-Transform (no proof only equations)			
3.2 ROC Definition, **study of ROC for**- finite duration right-sided(causal) signal, finite duration left-sided (anticausal) signal, finite duration two-sided (noncausal) signal			
3.2 **Properties of Z-transform(only proof, no problem solving)**-Linearity ,shifting, one sided, time reversal, convolution theorem			
3.3 Advantages of Z-Transform			
4. Discrete Fourier Transform(DFT) and Fast Fourier Transform(FFT)	15	**8**	**CO 1,2**
4.1 Definition of DFT, inverse DFT((no proof only equations)			
4.2 **Properties of DFT(only proof, no problem solving)**-Linearity, Periodicity, Time reversal, circular time shift			
4.3 Definition –FFT • Radix-2 DIT FFT-explanation of basic computation and butterfly diagram • Radix-2 DIF FFT-explanation of basic computation and butterfly diagram • Differences and similarities of DIT and DIF Radix-2 FFT			
5. FIR and IIR filters	12	**8**	**CO 1,4**
5.1 FIR filters • Definition ,advantages and Disadvantages • Define window, state different types of window sequences, procedure for designing FIR filter using windows • Define window, state different types of window sequences, procedure for designing FIR filter using windows			
5.2 **IIR Filters-** • IIR filters- Definition ,advantages and Disadvantages • Comparison of analog and digital filters			

• Frequency response of analog and digital IIR filter • Properties of butterworth and chebychev filters			
Total	75	48	

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**Introduction to Digital Signal Processing**	05	06
2	**Discrete Time signals and Systems**	15	24
3	**Z transforms**	12	18
4	**Discrete Fourier Transform(DFT) and Fast Fourier Transform(FFT)**	08	15
5	**FIR and IIR filters**	08	12
	TOTAL	**48**	**75**

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical
1	Introduction to toolbox and its various instructions
2	Program to generate unit step, unit ramp, Unit impulse, sinusoidal
3	Program to study basic operation on Discrete time signal-amplitude scaling, shifting
4	Program for linear convolution
5	Program to perform Z transform for the given sequence
6	Program to perform Discrete Fourier Transform for the given sequence
7	Program to design FIR filter using rectangular window
8	Program to perform Radix-2 DIT FFT and Radix-2 DIF FFT
1	At least 02 assignments

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Nagoor Kani	Digital Signal Processing	Tata McGraw Hill, India, ISBN:978-0-07-008665-4
2	Anand Kumar	Digital Signal Processing	PHI Learning- ISBN-978-81-203-4620-8 (downloadable)

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	V K Khanna	Digital Signal Processing	S Chand
2	Oppenheim & Schafer	Digital Signal Processing	Pearsons Education