West Bengal State Council of Technical & Vocational Education and Skill Development
(Technical Education Division)

Syllabus
of

Diploma in Electronics & Tele-Communication Engineering [ETCE] & Electronics & Communication Engineering [ECE]

Part-II (3rd Semester)

Revised 2022

Further suggestion may be submitted to the syllabus committee. List of the coordinators for the branch of Diploma in Electronics & Tele Communication Engineering are:

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WEST BENGAL STATE COUNCIL OF TECHNICAL EDUCATION

TEACHING AND EXAMINATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES

COURSE NAME: FULL TIME DIPLOMA IN ELECTRONICS & TELECOMMUNICATION ENGINEERING

DURATION OF COURSE: 6 SEMESTERS

SEMESTER: THIRD

BRANCH: ELECTRONICS & TELECOMMUNICATION ENGINEERING

SR. NO.	SUBJECT	CREDITS	PERIODS		EVALUATION SCHEME						
			L	PR	THEORETICAL				PRACTICAL		Total Marks
					TA	CT	Total	ESE	Internal	External	
1.	Principles of Electronic Communication	3	3	-	20	20	40	60	-	-	100
2.	Electronic Devices and Circuits	3	3	-	20	20	40	60	-	-	100
3.	Digital Electronics	3	3	-	20	20	40	60	-	-	100
4.	Electric circuits and network	3	3	-	20	20	40	60	-	-	100
5.	Computer Programming Language	3	3	-	20	20	40	60	-	-	100
6.	Principles of Electronic Communication Lab	1	-	2	-	-	-	-	60	40	100
7.	Electronic Devices and Circuits Laboratory	1	-	2	-	-	-	-	60	40	100
8.	Digital Electronics Laboratory	1	-	2	-	-	-	-	60	40	100
9.	Electric circuits and network Laboratory	1	-	2	-	-	-	-	60	40	100
10.	Computer Programming Language Laboratory	1	-	2	-	-	-	-	60	40	100
11.	Internship-I	1	-	-	-	-	-	-	100	-	100
	Total	21	15	10	100	100	200	300	400	200	1100

- **STUDENT CONTACT HOURS PER WEEK: 25 hours**
- **ACADEMIC CONTACT WEEKS PER SEMESTER : 17 weeks (Teaching-15 weeks + Internal Exam-2 weeks)**
- **THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH**
- **ABBREVIATIONS: L- Lecture, PR- Practical, IA- Internal Assessment, CT- Class Test, ESE- End Semester Exam**
- **IA (Internal Assessment for Theoretical) = 40 marks: CT= 20 Marks, Attendance =10 marks and Quizzes/Assignment/Student Activity = 10 marks.**
- **Minimum qualifying marks for both Theoretical and Sessional subjects (for internal assessment and external assessment separately) are 40%.**
- **IA (Internal Assessment for Practical) =60 marks: 50 marks for continuous evaluation and 10 marks for Class attendance.**
- **Internship-I will be completely assessed internally.**

Name of the course: **Principles of Electronic Communication**	
Course Code: ETCE/PEC/S3	Semester: Third
Duration: One Semester (Teaching - 15 weeks + Internal Exam-2 weeks)	Maximum Marks: 100 Marks
Teaching Scheme:	**Examination Scheme**
Theory: 3 contact hrs./ week	Class Test (Internal Examination): 20 Marks
Practical: 2 contact hours/ week	Attendance =10 marks and Quizzes/Assignment/Student Activity = 10 marks
	End Semester Examination: 60 Marks
Credit: 4 (TH:3+PR:1)	Practical: 100 Marks

Course Outcomes:

On completion of the course students will be able to :

- Describe the basic structure of a telecommunication system, frequency and time domain representation of a signal.
- Know how and why signals are modulated and different types of analog modulation system including pulse modulation and also the demodulation process of modulated signals.
- Understand the functions and operating principles of transmitting and receiving systems with clear idea of basic telephony system, electronic exchange and switching systems used in telephony.
- Acquire knowledge on propagation of electromagnetic wave of different frequency bands and using various methods.
- Differentiate the analog and digital communication systems and understand the form of digital data including information theory, error correction and coding methods.

Content (Name of the topic)		Periods
Group – A		
Unit 1	**Basics of Electronic communication**	**05**
	1.1 Electromagnetic spectrum, elements of basic electronic communication system 1.2 Concept of noise, signal to noise ratio 1.3 Idea of simplex, half duplex and full duplex 1.4 Basic idea of Fourier series and Fourier transform	
Unit 2	**Analog modulation techniques**	**09**
	2.1 Concept of modulation and need for modulation 2.2 Amplitude Modulation(AM) – Mathematical representation of AM wave, Modulation Index, percentage of modulation, Bandwidth and side bands, Representation of AM wave in time domain and frequency domain, Concept of DSB, SSB and VSB, Power requirement in AM wave 2.3 Frequency Modulation(FM) -Mathematical representation of FM wave, Frequency deviation, Modulation Index, Representation of FM wave in time domain and frequency domain, Bandwidth requirement, NB and WB frequency modulation 2.4 Phase Modulation(PM) - Mathematical representation of PM wave, Modulation Index 2.5 Comparison of AM, FM and PM	
Group – B		

Unit 3	**Transmitter and Receiver**	**09**
	3.1 Generation of AM wave – Collector modulated class C amplifier for generation of AM wave, operation of Balanced Modulator, Filter method for SSB generation, Block diagram of AM broadcast transmitter 3.2 Receiver of AM – Block diagram of AM super heterodyne receiver and its working principle, IF amplifier and choice of IF, Mixer and converter, Alignment and tracking, Receiver characteristics and testing, sensitivity, selectivity and fidelity 3,3 Demodulation of AM – Envelop detector, AGC and delayed AGC circuit and its operation 3.4 Generation of FM wave – Direct (Varactor diode modulator) and Indirect (Armstrong) method, Block diagram and operation of FM broadcast transmitter 3.5 Receiver of FM – Block diagram and operation of FM receiver, Pre-emphasis and De-emphasis, AFC and PLL 3.6 Demodulation of FM – Foster-Seeley discriminator, ratio detector, limiter	
Unit 4	**Wave propagation**	**05**
	4.1 Concept of Electromagnetic Wave and its properties – Transverse electromagnetic wave, concept of plane and spherical wavefronts, Reflection, Refraction, Polarization, Diffraction, radiation, absorption, attenuation, interference 4.2 Ground wave propagation – VLF propagation 4.3 Sky wave propagation – Ionosphericlayers, virtual height, critical frequency, MUF, skip distance 4.4 Space wave propagation – Line of sight propagation, multipath space wave propagation, Radio horizon, Duct propagation (microwave space wave propagation) 4.5 Tropospheric scatter propagation	
Unit 5	**Telephony**	**06**
	5.1 Block diagram and operation of Telephone hand set, Transmitter, Receiver, side tone and anti-side tone circuit and operation, ringer, switch hook, tone dialing, DTMF, Hybrid circuit and its operation, local loop 5.2 Block diagram of Electronic exchange, Space division switching, Time division switching 5.3 Numbering plan of telephone network- National and International scheme of numbering plan	
Group – C		
Unit 6	**Analog Pulse Modulation**	**05**
	6.1 Introduction and comparison with continuous wave modulation and advantages, Sampling Theorem, Nyquist rate, natural and flat top sampling 6.2 Definition, principle of generation and reception of PAM (Pulse Amplitude Modulation), PWM (Pulse Width Modulation) and PPM (Pulse Position Modulation) with block diagram and applications	
Unit 7	**Digital Communication Systems and Coding Methods**	**06**

	7.1 Idea of Digital Communication – Advantages of digital communication over analog communication, Elements of digital communication system with block diagram – source, channel, transmitter and receiver 7.2 Channel characteristic – Bit rate, Baud rate, channel capacity, Synchronous and Asynchronous data 7.3 Information Theory – Relationship between data speed and channel capacity, Hartley's Law, Hartley – Shannon Theorem 7.4 Error correction – Causes of error and its effect, error detection and correction using Parity Check, Cyclic Redundancy Check (CRC) 7.5 Idea of Inter Symbol Interference (ISI) and interpretation of EYE diagram 7.6 Line coding format – RZ, NRZ, AMI and Manchester code	
	Total	**45**

Sl. No.	**Suggested List of Laboratory Experiments**
1	To study generation of AM signal and the waveforms
2	To study Envelop detector for demodulation of AM and observe the effect
3	To study generation of FM signal using varactor and reactance modulator and the waveforms
4	To study detection of FM signal using Foster Seeley method.
5	To study the frequency spectrum of AM and FM using spectrum analyzer
6	To study super heterodyne AM receiver and measurement receiver parameters as i)Sensitivity, ii) selectivity and iii) Fidelity
7	To study PAM modulation and demodulation
8	To study PWM modulation and demodulation
9	To study PPM modulation and demodulation
10	To study the analog signal sampling and reconstruction for different sampling frequency
11	To study the different blocks of a telephone receiver
12	Mini projects on (A) AM radio receiver (B) FM radio receiver (C) AM transmitter (D) FM transmitter

Name of the course: **Electronic Devices and Circuits**	
Course Code: ETCE/EDC/S3	Semester: Third
Duration: One Semester (Teaching - 15 weeks + Internal Exam-2 weeks)	Maximum Marks: 100 Marks
Teaching Scheme:	**Examination Scheme**
Theory: 3 contact hrs./ week	Class Test (Internal Examination): 20 Marks
Practical: 2 contact hours/ week	Attendance =10 marks and Quizzes/Assignment/Student Activity = 10 marks

	End Semester Examination: 60 Marks
Credit: 4 (TH:3+PR:1)	Practical: 100 Marks

Course Outcomes:

On completion of the study of the subject a student should be able to:

- Explain the principle of operation and application of different types of diodes viz. Rectifiers (without filters and with filters), Clippers and Clampers.
- Discuss the working principle of BJT, its biasing circuit, different types of gains in terms of h-parameter and stabilization of their operating points.
- Compare different types of Coupling in Amplifier
- Explain the construction and working principle of JFET, MOSFET and UJT
- Illustrate and compare the performance of different types of Power amplifiers.
- Explain different types of feedback in amplifiers, illustrate the effect of feedback on different parameters of an amplifier and hence, deduce the concept of oscillation.

Content (Name of the topic)		Periods
Group – A		
Unit 1	**Diodes and their applications**	**07**
	1.1 Half Wave and Full Wave Rectifiers(with Centre Tapped Transformer and Bridge) : Average voltage – R.M.S. voltage, efficiency and ripple factor, Percentage voltage regulation & TUF 1.2 Function of filter circuits – Capacitor input filter – Inductive filter – PI filter – Calculation of ripple factor and average output voltage 1.3 Diode wave shaping circuits – clipper and clamper circuits 1.4 Zener diode, Zener breakdown & Avalanche Breakdown. 1.5 Varactor diode & Schottky diode.	
Unit 2	**Bipolar Junction Transistor and its biasing**	**08**
	2.1 Transistor configurations (CB, CE & CC), input and output characteristics. α, β, and γ factors 2.2 Comparison of CB, CE, and CC configurations 2.3 Concept of Q-point, ac and dc load lines 2.4 Stabilization and stability factor 2.5. BIASING: Base bias — Collector feedback bias — Emitter feedback bias — Potential divider bias.	
Group – B		
Unit 3	**Small Signal Transistor Amplifiers**	**07**
	3.1 Hybrid model and h-parameters of CB, CE & CC mode transistor amplifiers – Calculation of voltage gain, current gain, power gain, input and output impedance in terms of h-parameters 3.2 High frequency model of BJT 3.3 Types of Coupling in Amplifier: RC coupled, Direct coupled & Transformer-coupled amplifiers; their relative advantages and disadvantages. 3.4 Effect of cascading on Gain & Bandwidth and Frequency response	

Unit 4	**JFET, MOSFET AND UJT**	**08**
	4.1 Field Effect Transistors: FET – Working Principle, Classification 4.2 N-Channel/ P-Channel MOSFETs – characteristics, enhancement and depletion mode, MOSFET as a Switch 4.3 MOSFET Small Signal model 4.4 Small signal FET equivalent circuits – Common Source and Common Drain amplifier – FET application as VVR, Constant Current Source etc. 4.5 Uni-Junction Transistor – equivalent circuit, operation and application.	
	Group – C	
Unit 5	**Power Amplifier**	**06**
	5.1 Characteristics of Class A, Class B, Class C and Class AB amplifier 5.2 Transformer Coupled Audio Power Amplifier- Impedance Matching and Maximum Power Output. 5.3 Push-Pull Amplifiers: Advantages of Push-Pull amplifier, Power considerations& Distortion in class B Push-Pull Amplifier.	
Unit 6	**Feedback Amplifier and concept of oscillation**	**09**
	6.1 Basic idea of positive and negative feedback 6.2 Basic Feedback Amplifier Topologies: Voltage Series, Voltage Shunt, Current Series, Current Shunt 6.3 Effect of negative feedback on gain, gain stability, distortion, noise, bandwidth, phase shift, input and output impedances 6.4 Performance of emitter follower circuit – Calculation of gain and input & output impedances 6.5 Barkhausen criteria and operation of Tuned Collector Oscillator.	
	Total	**45**

Sl. No.	**Suggested List of Laboratory Experiments**
1	To study the rectifier with and without capacitor filter for : — (a) Half-wave rectifier, (b) Full-wave rectifier,
2	To observe the waveform at the input and output of clipping circuits in different clipping configuration.
3	To study the operation of positive and negative clamper circuit.
4	To study the VI characteristics of a forward and reverse biased Zener diode.
5	To study the input and output characteristics and to determine the h-parameters of a BJT for : — (a) C-E configuration, (b) C-B configuration, (c) C-C configuration
6	To determine frequency response characteristics of RC coupled amplifier circuit and calculation of bandwidth, midband gain, input impedance and output impedance for : (a) Single-stage amplifier, (b) Double-stage amplifier
7	To study Drain Characteristics and Transfer Characteristics of a Field Effect Transistor (FET).

8	To study Drain Characteristics and Transfer Characteristics of a MOSFET.
9	To study the V-I characteristics of UJT (show the cut-off, saturation and negative resistance region)
10	To study the operation of a Class B Push-Pull Amplifier
11	To determine the frequency characteristics of a negative feedback amplifier and compare with that of an amplifier without feedback.

Name of the course: **Digital Electronics**	
Course Code: ETCE/DE/S3	Semester: Third
Duration: One Semester (Teaching - 15 weeks + Internal Exam-2 weeks)	Maximum Marks: 100 Marks
Teaching Scheme:	**Examination Scheme**
Theory: 3 contact hrs./ week	Class Test (Internal Examination): 20 Marks
Practical: 2 contact hours/ week	Attendance =10 marks and Quizzes/Assignment/Student Activity = 10 marks
	End Semester Examination: 60 Marks
Credit: 3 (TH:2+PR:1)	Practical: 100 Marks

Course Outcomes:

On completion of the course students will be able to :

- Describe the difference between Analog and Digital logic systems, different number systems and their conversions
- Know the rules and laws of Boolean Algebra, basic logic, derived and special logic gates, De-Morgan's theorem , minimization technique of Boolean expressions by using K- Map
- Understand the operation of different Combinational Logic Circuits like Adder, Subtractor, MUX, DEMUX, Encoder, Decoder etc
- Acquire knowledge on basic working principle of different types of FLIP-FLOPS like JK, SR, D, T, Master-Slave
- Have a clear idea of Asynchronous and synchronous counters, Ring and Twisted Ring Counters and Shift REGISTERS
- Understand ideas on different Memory Devices and different types of A to D and D to A converter.

Content (Name of the topic)		**Periods**
Group – A		
Unit 1	**NUMBER SYSTEMS AND CODES**	**03**
	1.1 Difference between Analog and Digital Logic system, Positive and Negative Logic system, Introduction to different number systems – Binary, Octal, Decimal, Hexadecimal and Conversion from one number system to another. 1.2 Gray code (unit distance code), BCD (weighted code), Excess3(self-complementary) code, ASCII, EBCDIC Code, conversion between Gray and Binary codes	
Unit 2	**LOGIC GATES, BOOLEAN ALGEBRA & SIMPLIFICATION OF LOGIC**	**08**

	EXPRESSIONS	
	2.1 Symbolic representation , truth table and expressions of different logic gates: BUFFER – (NOT, OR, AND) – (NAND,NOR)– (XOR, X-NOR) 2.2 Rules and laws of Boolean Algebra, Difference between boole and ordinary variables, Basic logic circuits, De-Morgan's theorem 2.3 Max. term and Min term – Canonical form of equation – Simplification of Boolean expressions 2.4 Karnaugh Map technique (upto 4 variables) – Don't care condition – Prime implicants – Canonical forms – Quine-McClusky method 2.5 Realization of Boolean expression with different logic gates	
Unit 3	**Combinational Logic Circuits**	**12**
	3.1 Arithmetic Circuits – Addition, Subtraction, 1's 2's Complement and 9's complement method of addition, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallal and Series Adders. 3.2 Realization of NAND and NOR as a universal Logic Gate, Realization of AND-OR is equivalent to NAND-NAND and OR-AND is equivalent to NOR-NOR 3.3 Different Code converters, Operation, Truth Table and Circuit diagram of 2: 4 ,3: 8 Decoder and 4: 16 Decoders, Cascading of Decoders, Realization of different Boolean functions by using Decoders, BCD to seven segment Decoder, Operation of 4: 2 Encoder, 8: 3 Encoder and Priority Encoder. 3.4 Multiplexer – Operation, Truth Table and Circuit diagram of 2 to 1 MUX, 4:1 MUX, 8:1 MUX and 16: 1 MUX. Cascading of MUX, Realization of Boolean functions by using MUX, Design of Universal Gate by using MUX. 3.5 Demultiplexer – Operation, Truth Table and Circuit diagram of 1:2 DEMUX, 1:4 DEMUX, 1:8 DEMUX, Conversion in between Decoder and Demultiplexer. 3.6 Design of 2,3,4 bit odd and even Parity Generator and Checker, Design of 2, 3 and 4 bit Binary Comparators.	
	Group – B	
Unit 4	**Sequential Logic Circuits (FLIP-FLOP)**	**05**
	4.1 Difference between Combinational and Sequential Logic Circuits, Idea of clock pulse, Concept of Flip Flops – Difference between flip flop and latch 4.2 Construction and Operation of RS, JK, D and T Flip Flops, Operation of preset and clear signal. Race Around Condition, Master slave JK Flip flop, Positive and Negative Edge triggered flip-flop, Excitation/ Transition Table of all Flip flops.	
Unit 5	**Sequential Logic Circuits (COUNTERS and REGISTERS)**	**08**
	5.1 Concept of Counter, Difference between Asynchronous and Synchronous counter – Operation of 3 & 4 bit Ripple UP/DOWN counter with timing diagram–Programmable ripple counter, Application of counter 5.2 Design of (a) Ring (N:1) counter with Truth Table and waveform diagram. (b) Johnson counter (2N:1) with Truth Table and waveform diagram. 5.3 Design of Synchronous counter with the help of RS, JK, D, and T Flip-Flop (e.g Mod 5,7,10 etc.) 5.4 Registers – 4bit Shift Register: Operation of Serial In Serial Out, Serial in Parallel Out, Parallel In Serial Out, Parallel In Parallel Out, Concept of Bidirectional Shift Register, Application of Shift Register	

Group – C		
Unit 6	**Memory Devices**	**04**
	6.1 Classification of Memories – RAM Organization, Address Lines and Memory Lines, Static RAM, Bipolar RAM, cell Dynamic RAM, D RAM, DDR RAM 6.2 Read Only memory – ROM organization, Expanding memory, PROM, EPROM, EEPROM, Flash memory CDROM 6.3 Digital Logic Arrays- PLA, PAL, GAL, FPLA, FPGA	
Unit 7	**Data Converters**	**05**
	7.1 DIGITAL TO ANALOG CONVERTERS: Binary weighted resistor type DAC, R-2R ladder type DAC, specifications and applications of DAC. 7.2 ANALOG TO DIGITAL CONVERTER: Comparator type, Successive approximation type, Dual slope AD converter specifications and applications of AD converter.	
	Total	**45**

Sl. No.	**Suggested List of Laboratory Experiments**
1	To verify the truth tables for all logic fates – NOT, OR ,AND, NAND, NOR ,XOR and XNOR using CMOS Logic gates [CMOS ICs4001,4011,4030,4070,4071,4077,4081,4093] and TTL Logic Gates [TTL ICs-7400,7402,7404,7408,7432,7486]
2	Implement and realize Boolean Expressions with different Logic Gates
3	Implement Half Adder, Full Adder, Half Sub tractor and Full sub tractor by using different digital ICs
4	Realization of parallel and serial full-adder using ICs (IC- 74LS83)
5	To implement encoder (IC-74147), decoder (IC-74138), multiplexer (IC-74151) and demultiplexer (IC-74138).
6	Construct a Single digit Decade Counter (0-9) with 7 segment display (74LS90)
7	To construct 2 bit parity generator and checker & 2 bit comparator by using logic gates.
8	To verify the Truth Table of SR, D, JK and T Flip-flops (IC-74LS76)
9	To construct binary synchronous and asynchronous counter.
10	To design programmable up / down counter.
11	To design controlled shift register and study their function as SIPO.SISO, PIPO, PISO (by using IC74LS76)
12	To study different memory ICs.
13	To study DA and AD converters

Name of the course: **Electric Circuits and Network**	
Course Code: ETCE/ECN/S3	Semester: Third
Duration: One Semester (Teaching - 15 weeks + Internal Exam-2 weeks)	Maximum Marks: 100 Marks
Teaching Scheme:	**Examination Scheme**
Theory: 3 contact hrs./ week	Class Test (Internal Examination): 20 Marks

Practical: 2 contact hours/ week	Attendance =10 marks and Quizzes/Assignment/Student Activity = 10 marks
	End Semester Examination: 60 Marks
Credit: 4 (TH:3+PR:1)	Practical: 100 Marks

Course Outcomes:

On completion of the course students will be able to :

- Simplify networks using graph theory or proper reduction techniques.
- Solve two-port network and resonant circuit.
- Design filter, attenuator and equalizer circuit.
- Interpret the circuit response and output spectrum by using Laplace and Fourier Transform respectively.
- Develop an understanding on Transmission Lines.

Content (Name of the topic)		Periods
Group – A		
Unit 1	**Basic of Network and Network Theorems**	**09**
	1.1 Kirchhoff's Voltage Law, Kirchhoff's Current Law, Voltage divider, current divider rule, star – delta conversion, Source Transformation and duality. 1.2 Node and Mesh Analysis using Independent and Controlled Source 1.3 Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem – simple problems. 1.4 Idea of resonance – series and parallel resonant circuits – Q value, Selectivity and Bandwidth.	
Unit 2	**Graph Theory**	**03**
	2.1 Graph of a network, tree, incident matrix, concepts of path, cycle and tree, independent loops 2.2 F – Tie Set and analysis of resistive network using tie – set 2.3 F - Cut Set and analysis of resistive network using cut – set. Duality.	
Unit 3	**Two Port Network**	**06**
	3.1 Introduction of Two Port Network - Open circuit impedance parameters, Short circuit impedance parameters, hybrid parameters, transmission parameters – simple problems. 3.2 Open and short circuit impedance, characteristics impedance and its relation with open and short circuit impedance, propagation constant and image impedance.	
Group – B		
Unit 4	**Filter Circuits**	**04**
	4.1 Definition and relationship between neper and decibel. 4.2 Basic idea of passive filters – definition of pass band, stop band, cut – off frequency. 4.3 Constant K – prototype filters: a) Low pass filter b) high pass filter c) Band pass filter d) Band reject filter 4.4 Active filter - Basic idea, advantages and disadvantages of basic filters, application of filter circuits.	
Unit 5	**Attenuators and Equalizers**	**04**

	5.1 Basic idea of attenuators, difference between attenuator and filter, symmetrical T and π attenuator – field of application of attenuators. 5.2 Concept of equalizer – purpose of equalizer and its classification – Difference between series & shunt equalizer and their field of applications	
Unit 6	**Transmission Lines**	**05**
	6.1 Types of transmission lines: Parallel wire and coaxial cable 6.2 Primary and secondary constants of transmission lines 6.3 Characteristic impedance – Reflection co-efficient – Standing wave ratio and their relationship 6.4 Simple matching methods, single and double stub match for transmission lines 6.5 Losses in transmission lines 6.6 Distortion in transmission line – Causes of distortion and condition for distortion less transmission – Practical feasibility for distortion less transmission	
	Group – C	
Unit 7	**Laplace Transform**	**09**
	7.1 Laplace Transform and its properties 7.2 Analysis of electrical circuits using Laplace transform for standard inputs (unit step, ramp) 7.3 Initial and Final Conditions for network elements 7.4 Forced and free response, time constants 7.5 Steady state and transient state response 7.6 Solution of 1st and 2nd order differential equations for series and parallel RL, RC, RLC circuits 7.7 Inverse Laplace Transform	
Unit 8	**Fourier Series**	**05**
	8.1 Discrete spectra and symmetry of waveforms for Exponential and Trigonometric Fourier Series 8.2 Steady state response of a network to non-sinusoidal periodic inputs, power factors, effective values. 8.3 Fourier Transform and continuous spectra	
	Total	**45**

Sl. No.	**Suggested List of Laboratory Experiments**
1	To verify node and mesh analysis using independent and controlled sources
2	To verify Thevenin's and Norton's theorems
3	To verify Superposition theorem.
4	To verify Maximum Power Transfer theorem and Reciprocity Theorem.
5	To verify characteristics of Series resonant Circuit
6	To verify characteristics of Parallel resonant Circuit
7	To measure the characteristic impedance of symmetrical T and π networks

8	To measure the cut –off frequencies of the following: — (a) constant k-type low pass filter; (b) constant k-type high pass filter;
9	To measure T and π type attenuator
10	To observe standing wave pattern for a transmission line of finite length with: (a) open termination, (b) shorted termination and (c) matched termination,
11	To measure the attenuation constant and phase shift constant for matched termination.

Name of the course: **Computer Programming Language**	
Course Code: ETCE/CPL/S3	Semester: Third
Duration: One Semester (Teaching - 15 weeks + Internal Exam-2 weeks)	Maximum Marks: 100 Marks
Teaching Scheme:	**Examination Scheme**
Theory: 3 contact hrs./ week	Class Test (Internal Examination): 20 Marks
Practical: 2 contact hours/ week	Attendance =10 marks and Quizzes/Assignment/Student Activity = 10 marks
	End Semester Examination: 60 Marks
Credit: 3 (TH:2+PR:1)	Practical: 100 Marks

Course Outcomes:

On completion of the course students will be able to :

- Understand the concept of hardware and software part of a computer.
- Explain compiler, interpreter, linker and loader function.
- Understand flow charts and algorithms and the basic structure of a program in C.
- Learn about one dimensional array and pointers.
- Understand the definition of a function and its advantages.
- Understand the concept of Object Oriented Programming.

Content (Name of the topic)		**Periods**
Group – A		
Unit 1	**Computer Fundamentals**	**07**
	1.1 Introduction of computers, Classification of computers, Anatomy of a computer, Memory hierarchy, Introduction to OS, Operational overview of a CPU. 1.2 Generation and classification of programming languages, Compiling, Interpreting, Loading, Linking of a program, Developing program, Software development. 1.3 Flow chart and algorithm development.	
Unit 2	**Basics of C**	**07**

	2.1 Overview of C, Structure of a C program, Comments, Program statements, C tokens, Keywords, Identifiers, Data types, Variables, Constants, Operators, Expressions and precedence. 2.2 Non-formatted and formatted input and output functions.	
Unit 3	**Control Statements**	**06**
	3.1 Selection statements – if, if-else, nested if, nested if-else, comma operator, conditional operator, switch. 3.2 Iterative statements – while, for, do-while. 3.3 Special control statements – goto, break, continue, return, exit.	
	Group – B	
Unit 4	**Arrays and Pointers**	**09**
	4.1 Introduction of one-dimensional arrays, Declaration and initialization of Array, Accessing of array elements and other allowed operations, Definition of header file, Use of header files, Different header files, Functions from ctype.h, string.h, Simple program with a one dimensional array. 4.2 Understanding pointers, declaring and accessing pointer, '&' and '*' operators, Pointer expressions, Pointer assignments, Pointer arithmetic.	
Unit 5	**Functions**	**07**
	5.1 Concept of function, Using functions, Call-by-value Vs Callby-reference, Passing arrays to functions, Recursion, Simple programs.	
Unit 6	**Basic Concepts of Object Oriented Programming**	**09**
	6.1 Introduction to Object Oriented Programming, Concepts of Objects and Classes.	
	Total	**45**

Sl. No.	**Suggested List of Laboratory Experiments**
1	Familiarization with programming environment (Editor, Compiler, etc.)
2	Verify the programs using I/O statements and various operators
3	Verify the programs to check whether a number is even or odd
4	Verify the programs to find the sum of n natural numbers
5	Verify the programs to find the largest and smallest number among five numbers
6	Verify the programs to find factorial of a number
7	Verify the programs to display Fibonacci sequence
8	Verify the programs to find GCD and LCM of two numbers
9	Verify the programs to count number of digits in an integer
10	Verify the programs to demonstrate recursion
11	Verify the programs to demonstrate use of pointers
12	Verify the programs to sort 10 elements in ascending or descending order

13	Verify the programs to find the summation of three numbers using function
14	Verify the programs to find the maximum between two numbers using function

Name of the course: **Internship-I**	
Course Code: ETCE/INT-I/S3	Semester: Third
Duration: During vacation	Maximum Marks: 100 Marks
Credit: 1	
Students are required to be involved in Inter/Intra Institutional activities viz: Training and simulation program with different Institutes like Workshop of ITI, Other Polytechnics and other technical institutes; Soft skill training organized by Training and Placement Cell of the respective institutions, contribution at innovation/entrepreneurship cell of the institute; participation in workshops/competitions etc.; Learning at Departmental Lab/Institutional workshop.	
Course Outcomes:	
On completion of the course students will be able to : • Understand the real time industrial environment. • Get exposure about entrepreneurship development. • Learn about the training and simulation program of the industry/institute. • Handle different Industrial/Institutional equipments/machineries.	

West Bengal State Council of Technical & Vocational Education and Skill Development
(Technical Education Division)

Syllabus
of

Diploma in Electronics & Tele-Communication Engineering [ETCE] & Electronics & Communication Engineering [ECE]

Part-II (4th Semester)

Revised 2022

Further suggestion may be submitted to the syllabus committee. List of the coordinators for the branch of Diploma in Electronics & Tele-Communication Engineering is:

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WEST BENGAL STATE COUNCIL OF TECHNICAL EDUCATION

TEACHING AND EXAMINATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES

COURSE NAME: FULL TIME DIPLOMA IN ELECTRONICS & TELECOMMUNICATION ENGINEERING

DURATION OF COURSE: 6 SEMESTERS

SEMESTER: FOURTH

BRANCH: ELECTRONICS & TELECOMMUNICATION ENGINEERING

SR. NO.	SUBJECT	CREDITS	PERIODS			EVALUATION SCHEME						
						THEORETICAL				PRACTICAL		Total
			L	TU	PR	TA	CT	Total	ESE	Internal	External	Marks
1.	Microcontroller and Applications	3	3	-	-	20	20	40	60	-	-	100
2.	Consumer Electronics	3	3	-	-	20	20	40	60	-	-	100
3.	Linear Integrated Circuits	4	3	1	-	20	20	40	60	-	-	100
4.	Electronic Measurements and Instrumentation	3	3	-	-	20	20	40	60	-	-	100
5.	Digital and Microwave Communication Systems	3	3	-	-	20	20	40	60	-	-	100
6.	Microcontroller and Applications Lab	1	-	-	2					60	40	100
7.	Consumer Electronics Lab	1	-	-	2					60	40	100
8.	Linear Integrated Circuits Lab	1	-	-	2					60	40	100
9.	Electronic Measurements and Instrumentation Lab	1	-	-	2					60	40	100
10.	Digital and Microwave Communication Systems Lab	1	-	-	2					60	40	100
	Total	21	15	1	10	100	100	200	300	300	200	1000

- **STUDENT CONTACT HOURS PER WEEK: 26 hours**
- **ACADEMIC CONTACT WEEKS PER SEMESTER: 17weeks (Teaching-15weeks + Internal Exam-2weeks)**
- **THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH**
- **ABBREVIATIONS: L-Lecture, PR-Practical, IA-Internal Assessment, CT-Class Test, ESE- End Semester Exam**
- **IA (Internal Assessment for Theoretical) = 40marks: CT = 20 Marks, Attendance = 10 marks and Quizzes / Assignment / Student Activity = 10 marks.**
- **Minimum qualifying marks for both Theoretical and Sessional subjects (for internal assessment and external assessment separately) are 40%.**
- **IA (Internal Assessment for Practical) = 60 marks: 50 marks for continuous evaluation and 10 marks for Class attendance.**

Name of the course: Microcontroller and Applications	
Course Code: ETCE/DMICA/S4	Semester: Fourth
Duration: One Semester(Teaching-15 Weeks + Internal Exam-2 weeks)	Maximum Marks:100 Marks
Teaching Scheme:	**Examination Scheme**
Theory:3contact hours/ week	Class Test(Internal Examination):20 Marks
Practical:2contact hours/week	Attendance=10 marks and Quizzes/Assignment/Student Activity=10 marks
	End Semester Examination: 60 Marks
Credit:4(TH:3+PR:1)	Practical:100 Marks

Course Outcomes:

On completion of the course students will be able to:

- Develop the knowledge of further study on advanced Microcontroller
- Implement Timer logic, serial transmission and interrupt handling through programming.
- Prepare them for work in Microcontroller based automated systems
- Increase their skill to prepare Microcontroller based mini project.

Content(Name of the topic)		Periods
Group – A		
Unit1	**Introduction and Basics of 8051 Microcontroller**	**08**
	1.1 Harvard and Von-neuman Architecture, Introduction of Microprocessor and Microcontroller, Comparison between Microprocessor and Microcontroller. 1.2 Details Architecture of 8051 along with its Memory organization and Boolean processor 1.3 Intel MCS51 family features (8951, 8952, 8031, 8751)	
Unit2	**Instruction set and programming with 8051**	**14**
	2.1 8051 instruction set, addressing modes 2.2 Assembly Language programming (ALP), I/O Programming 2.3 Program on interrupt handling, programming counters / timers, Simple program on serial communication 2.4 Software Development cycle- editor, assembler, cross compiler, linker, locator, compiler 2.5 Assembler Directives: ORG, DB, EQU, END, CODE, DATA.	
Group – B		
Unit 3	**External Interfaces with 8051 using C programming**	**14**
	3.1 Memory interfacing (Program and Data memory) and Timers/Counters programming 3.2 I/O interfacing – keyboard, LCD, LED, 7 segment display, stepper motor 3.3 Real world interface - ADC, DAC, SENSORS, Communication interface [RS 232], Interrupt programming	
Group – C		
Unit 4	**Applications of 8051 Microcontroller**	**05**

	4.1 Square wave generation using port pins of 8051, Square and triangular waveform generation using DAC, Water level controller, Temperature controller using ADC 4.2 Stepper motor control for clockwise, anticlockwise rotation, Traffic light controller	
Unit 5	**ARM processor core based microcontrollers**	**04**
	5.1 Need for RISC Processor-ARM processor fundamentals, Basics of ARM core based controller [LPC214X], and simple applications on it.	
	Total	**45**

Sl. No.	**Suggested List of Laboratory Experiments**
1	To develop programming using ASM and C, and implementation in flash 8051 microcontroller
2	To develop programming with Arithmetic logic instructions [Assembly] (8051 microcontroller)
3	To develop programming of sorting an array [Assembly] (8051 microcontroller)
4	To develop programming using Ports [Assembly and C] (8051 microcontroller)
5	To develop programming for Delay generation using Timer [Assembly and C] (8051 microcontroller)
6	To develop a programming for interrupt handling [Assembly and C] (8051 microcontroller)
7	To develop programming for implementation of standard UART communication (using hyper terminal) [Assembly and C] (8051 microcontroller)
8	To develop programming for interfacing with LCD Display. [Assembly and C] (8051 microcontroller)
9	To develop programming for interfacing with Keypad [Assembly and C] (8051 microcontroller)
10	To develop programming for interfacing ADC/DAC [Assembly and C] (8051 microcontroller)
11	To develop programming for interfacing with stepper motor. [Assembly and C] (8051 microcontroller)
12	To develop Pulse Width Modulation Programming in ARM Microcontroller using simulator.
13	To develop GPIO programming in ARM microcontroller. [C Programming]
14	To develop Timers programming in ARM Microcontroller. [C Programming]

References:

Sl No.	**Title of Book**	**Author**	**Publication**
1.	The 8051 Micro Controller and Embedded Systems	Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely	PHI Pearson Education, 5th Indian reprint
2.	Microprocessor and Microcontrollers	Krishna Kant	Eastern Company Edition, Prentice Hall of India, New Delhi
3.	Microprocessor & Microcontroller Architecture: Programming & Interfacing using 8085,8086,8051	Soumitra Kumar Mandal	McGraw Hill Edu,
4.	Microcontrollers: Architecture implementation and Programming	Tabak Daniel, Hintz Kenneth j	Tata McGraw Hill, 2007
5.	ARM Developer's Guide.UM10139 LPC214X User manual – Rev.4	Andrew N.Sloss, Dominic Symes, Chris Wright	User manual – Rev.4
6.	Microprocessors and interfacing:	Douglas V. Hall	Tata McGraw Hill, 2editon, 2007

	programming and hardware		
7.	"Microcontroller – Fundamentals and Applications with Pic	Valder – Perez	Yeesdee Publishers, Tayler & Francis
8.	Microprocessors and Microcontrollers	N. Senthil Kumar, M. Saravanan, S Jeevananthan	Oxford University Press
9.	Microcontrollers: Architecture, Programming, Interfacing and System Design, 2e	Raj Kamal	Pearson

Suggested Scheme of Question Paper for End Semester Examination: [Duration 3 hours]

A: Multiple Choice Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
A1	**1&2**	**06**	**10**	**10x01=10**
A2	**3**	**05**		
A3	**4&5**	**04**		
	Total:	**15**	**10**	**10**
B: Fill-in the Blank Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
B1	**1&2**	**06**	**10**	**10x01=10**
B2	**3**	**05**		
B3	**4 & 5**	**04**		
	Total:	**15**	**10**	**10**
C: Short Answer Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
C1	**1&2**	**06**	**10**	**10x01=10**
C2	**3**	**05**		
C3	**4 & 5**	**04**		
	Total:	**15**	**10**	**10**
			Sub-Total[A+B+C]:	**30**
D: Subjective Type Questions (Carrying 2 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
D1	**1&2**	**04**	**06**	**06x02=12**
D2	**3**	**03**		
D3	**4 & 5**	**03**		
	Total:	**10**	**06**	**12**
E: Subjective Type Questions (Carrying 6 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
E1	**1&2**	**04**	**03**	**06x03=18**
E2	**3**	**02**		
E3	**4 & 5**	**02**		
	Total:	**08**	**03**	**18**
			Sub-Total[D+E]:	**30**
			Total[A+B+C+D+E]:	**60**

Name of the course: Consumer Electronics	
Course Code: ETCE/DCNE/S4	**Semester: Fourth**
Duration: One Semester (Teaching–15 weeks + Internal Exam-2 weeks)	Maximum Marks: 100 Marks
Teaching Scheme:	**Examination Scheme:**
Theory: 3 contact hrs./week	Class Test (Internal Examination): 20 Marks
Practical: 2 contact hours/week	Attendance=10 marks and Quizzes /Assignment /Student Activity =10 marks
	End Semester Examination: 60 Marks

Credit: 4(TH:3+PR:1)	Practical: 100 Marks

Rationale:

Need of Consumer Electronics based appliances are essential in our daily life. This requires large number of technically skilled persons in the relevant industries. Looking towards to present need and to fulfill future demand the knowledge of consumer products/appliances are necessary for our diploma students.

This course will introduce students about working principles of consumer electronics-based appliances like microphones, loudspeakers, TVs, photocopier, microwave Oven, washing machine, air conditioners, refrigerators, digital camera and cam coders to develop their skills for troubleshooting in a systematic way. This will help them to develop their own production house as well as to start up their own enterprises.

Course Outcomes:

After completion of the course students will be able to:

- Record the characteristics of microphones and loudspeakers.
- Create home theatre sound system and surrounded sound system in both analog and digital domain.
- Troubleshoot different colour TV receivers.
- Select different TV receivers based on their interface criteria.
- Maintain different consumer electronic appliances.

Content (Name of the topic)		Periods
Group – A		
Unit 1	**Audio Fundamentals and Devices**	**07**
	1.1 Basic Characteristics of sound signals; audio level metering; acoustic measuring in decibel level 1.2 Characteristics of microphones, Principle of operations, constructions, Advantages and disadvantages, Applications of: Moving Coil Microphone, Wireless Microphone etc. 1.3 Characteristics of Loudspeakers, Principle of operations, constructions, Advantages and disadvantages, Applications of Direct and Indirect type loudspeaker, Types of Baffles; Multi-way Speakers (Woofer, Tweeter); Cross-over network 1.4 Sound recording principles and types: Optical and Digital recording	
Unit 2	**Audio Systems**	**05**
	2.1 Monophonic and stereophonic sound systems. Home Theatre sound system, surround sound system 2.2 Public address system: Its Block diagram and its applications 2.3 Digital Console Block diagram; working principle and applications. 2.4 FM tuner, ICs used in FM tuner TDA 7021T.	
Unit 3	**Television Systems**	**12**
	3.1 Monochrome TV Standards: Aspect Ratio, Flicker, Interlace Scanning, Resolution, Tonal gradation. 3.2 Composite Video Signal; Horizontal and Vertical Scanning. 3.3 Fundamental concepts of RGB colour systems and Colour theory (additive and subtractive colour mixing); Hue, Luminance; Saturation; Chrominance 3.4 Colour TV camera (CCD), Colour TV Standards	
Unit 4	**Television Receivers and Video Systems**	**10**

	4.1 Colour TV signals (I, Q, U, V); Working principle of PAL-D colour TV coder and decoder 4.2 Digital Televisions: - LCD, LED, PLASMA, HDTV, 3-D TV, projection TV 4.3 Block diagram of DTH receiver 4.4 Overview of different types of Interfaces: Video interface, Digital Video, SDI, HDMI Multimedia Interface, Digital Video Interface, Flash Drive, concept of Bluetooth and its applications	
Unit 5	**Home/Office Appliances**	**11**
	5.1 Operating principles, Diagrams and Controller: Photocopier; Microwave Oven; Washing machine; Air conditioners and Refrigerators; Digital camera and Cam coders.	
	Total	**45**

Sl No.	Suggested List of Laboratory Experiments
1.	Test the performance of speaker
2.	Measure voltage level to sketch composite video signal at different stages of TV receiver.
3.	Study the internal layout of black and white TV receiver.
4.	Study the internal layout of colour television
5.	Fault finding in given Colour TV: i) No color ii) Red Colour only iii) Blue color only iv) Green color only v) Magenta color only vi) Cyan only vii) Yellow only viii) No raster, No Sound.
6.	Test various sections of LED TV receivers.
7.	Installation of DTH trainer.
8.	Demonstration of Photocopier.
9.	Demonstration of Microwave Oven.
10.	Demonstration of Washing machine.
11.	Demonstration of Refrigerator.
12.	Demonstration of Digital Camera.

References:

Sl No.	Title of the Book	Name of the Author	Name of the Publishers
1.	Consumer Electronics	Bali S.P.	Pearson Education India,2010, latest
2.	Audio video systems: principle practices & troubleshooting	Bali R and Bali S.P	Khanna Book Publishing Co. (P) Ltd.,2010 Delhi, India, latest edition.
3.	Modern Television practices	Gulati R.R.	New Age International Publication (P) Ltd. New Delhi Year 2011, latest edition
4.	Audio video systems	Gupta R.G.	Tata McGraw Hill, New Delhi, India
5.	Mastering Digital Television	Whitaker Jerry &Benson Blair	McGraw-Hill Professional, 2010, latest edition
6.	Standard handbook of Audio engineering	Whitaker Jerry & Benson Blair	McGraw-Hill Professional, 2010, latest edition

Suggested Scheme of Question Paper for End Semester Examination: [Duration 3 hours]

A: Multiple Choice Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
A1	**1,2& 3**	**08**		
A2	**4&5**	**07**	**10**	**10x01=10**
	Total:	**15**	**10**	**10**
B: Fill-in the Blank Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
B1	**1,2& 3**	**08**		
B2	**4&5**	**07**	**10**	**10x01=10**
	Total:	**15**	**10**	**10**
C: Short Answer Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
C1	**1,2& 3**	**08**		
C2	**4&5**	**07**	**10**	**10x01=10**
	Total:	**15**	**10**	**10**
			Sub-Total[A+B+C]:	**30**
D: Subjective Type Questions (Carrying 2 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
D1	**1,2& 3**	**05**		
D2	**4&5**	**05**	**06**	**06x02=12**
	Total:	**10**	**06**	**12**
E: Subjective Type Questions (Carrying 6 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
E1	**1,2& 3**	**05**		
E2	**4&5**	**04**	**03**	**06x03=18**
	Total:	**09**	**03**	**18**
			Sub-Total[D+E]:	**30**
			Total[A+B+C+D+E]:	**60**

Name of the course: Linear Integrated Circuits	
Course Code: ETCE/DLIC/S4	**Semester: Fourth**
Duration: One Semester (Teaching– 15 weeks + Internal Exam-2 weeks)	Maximum Marks: 100 Marks
Teaching Scheme:	**Examination Scheme:**
Theory: 3 contact hrs./week+ Tutorial: 1 contact hours/week	Class Test (Internal Examination): 20 Marks
Practical: 2 contact hours/week	Attendance=10 marks and Quizzes /Assignment /Student Activity =10 marks
	End Semester Examination:60Marks
Credit: 5(TH:4+PR:1)	Practical: 100 Marks

Course Outcomes:

After completion of the course, students will be able to

- Analyze the operating principle of operational amplifier and design its various linear and non-linear application circuits.
- Distinguish IC and Discrete components, explain manufacturing process of IC and analyze how monolithic components are being developed.
- Gain knowledge about applications of few specific ICs – Function Generator, Multivibrator, Voltage to Frequency Converter, Analog Multiplier, PLL etc.

Content (Name of the topic)		Periods
Group – A		
Unit 1	**Operational Amplifier**	**15(Th)+5(Tu)**
	1.1 Circuit operation of differential amplifier – single & double ended 1.2 INTRODUCTION TO OPERATIONAL AMPLIFIER: Common mode rejection ratio – Bias current – Offset voltage and current – Slew rate and Frequency response – Open loop and closed loop gain – Input and output impedance - Concept of virtual ground, Inverting and non-inverting mode and their gain calculation (Sign Changer, Scale Changer, Phase Shift Circuits) 1.3 APPLICATIONS OF OPAMP: Voltage Follower, V-to-I and I-to-V converters, Instrumentation amplifier, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, 1.4 Low-pass, high-pass and band-pass Butterworth filters. 1.5 Oscillators using OPAMP - a) Hartley, b) Colpitt, c) Wein-bridge, d) Phase Shift, e) Crystal.	
Unit 2	**Waveform generators and special function ICs**	**12(Th)+4(Tu)**
	2.1 Sine-wave generators, Triangular wave generator, Saw-tooth wave generator, ICL8038 Function generator 2.2 Multivibrators - Operation of monostable, astable and bistable multivibrator with waveforms, Timer IC 555- internal block diagram and pin function, construction of different multivibrators with IC-555 2.2 IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator Monolithic switching regulator, Switched capacitor filter IC MF100 2.4 Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.	
Unit 3	**IC Fabrication and Circuit Configuration for Linear IC**	**10(Th)+4(Tu)**
	3.1 Advantages of ICs over discrete elements 3.2 TYPES OF ICS: Linear and Digital – Monolithic and Hybrid 3.3 Manufacturing process of monolithic ICs- Construction of monolithic bipolar transistor – Monolithic diodes – Integrated Resistors, Monolithic Capacitors – Inductors 3.4 Fabrication of NMOS, PMOS & CMOS 3.5 Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References	
Unit 4	**Analog Multiplier and PLL**	**8(Th)+2(Tu)**
	4.1 Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, 4.2 Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565.	
	Total	**45(Th)+15(Tu)**

Sl No.	Suggested List of Laboratory Experiments
1	To determine the following characteristics of op-amp**:** — a) input offset voltage, b) slew rate, c) non-inverting gain, d) inverting gain.
2	To study the following applications of op-amp using IC741**:** — a) clipper, b) clamper, c) Schmitt trigger, d) voltage follower
3	To study the operation of low-pass, high-pass and band-pass Butterworth filters.
4	To study the operation of Oscillators (any two) using OPAMP - a) Hartley, b) Colpitt, c) Wein-bridge, d) Phase Shift, e) Crystal.
5	To generate Sine-wave, Triangular wave and Saw-tooth wave using ICL8038 Function generator
6	To study the application of IC555 timer connected as**:** a) astable multivibrator, b) monostable multivibrator.
7	To study the operation of IC 723 Voltage Regulator
8	To study the operation of Current mirror
9	To study the operation of a) Frequency to Voltage converter and b) Voltage to Frequency converter
10	To study the operation of analog multiplier ICs and their applications
11	To study the operation of Voltage controlled oscillator

References:

Sl. No.	Name of the Author	Title of the Book	Name of the Publisher
1.	Boylestad & Nashalsky	Electronic Devices and Circuits	Pearsons Eduction
2.	David A. Bell	Electronic Devices and Circuits	Oxford University Press
3.	Design with operational amplifiers and analog integrated circuits, 3rd Edition	Sergio Franco	Tata McGraw-Hill
4.	Linear Integrated Circuits,	D.Roy Choudhry, Shail Jain	New Age International Pvt. Ltd
5.	System design using Integrated Circuits	B.S.Sonde	New Age Pub
6.	Analysis and Design of Analog Integrated Circuits	Gray and Meyer	Wiley International
7.	OP-AMP and Linear ICs	Ramakant A.Gayakwad	Prentice Hall / Pearson Education
8.	Operational Amplifier and Linear Integrated Circuits	K Lal Kishore	Pearson Education
9.	Anil K. Maini	Electronics Devices and circuits	Wiley
10	Chattopadhyay & Rakhshit	Basic Electronic & Linear Circuits	New Age International
11	Ramesh Babu	Electronic Devices & Circuits	Scitech
12	Shredhra Smith	Microelectronics	Oxford University Press
13	S. Salivanan,Umesh Kumar, Vallavaraj	Electronic Devices and Circuits	Tata McGraw-Hill
14.	Malvino	Electronic Principles	Tata McGraw-Hill
15	Milman & Halkias	Integrated Electronics	Tata McGraw-Hill
16	Ganesh Babu	Linear Integrated Circuits	SCITECH
17	Bhargava	Basic Electronic & Linear Circuits	Tata McGraw-Hill
18	Rashid	Microelectronics	Wiley
19	B. Visvesvara Rao	Linear Integrated Circuits	Pearson

20	Stanley	Operational Amplifiers with Linear Integrated Circuits, 4e	Pearson

Suggested Scheme of Question Paper for End Semester Examination: [Duration 3 hours]

A: Multiple Choice Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
A1	**1&2**	**09**		
A2	**3&4**	**06**	**10**	**10x01=10**
	Total:	**15**	**10**	**10**
B: Fill-in the Blank Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
B1	**1&2**	**09**		
B2	**3&4**	**06**	**10**	**10x01=10**
	Total:	**15**	**10**	**10**
C: Short Answer Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
C1	**1&2**	**09**		
C2	**3&4**	**06**	**10**	**10x01=10**
	Total:	**15**	**10**	**10**
			Sub-Total[A+B+C]:	**30**
D: Subjective Type Questions (Carrying 2 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
D1	**1&2**	**06**		
D2	**3&4**	**04**	**06**	**06x02=12**
	Total:	**10**	**06**	**12**
E: Subjective Type Questions (Carrying 6 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
E1	**1&2**	**05**		
E2	**3&4**	**04**	**03**	**06x03=18**
	Total:	**09**	**03**	**18**
			Sub-Total[D+E]:	**30**
			Total[A+B+C+D+E]:	**60**

Name of the course: Electronic Measurements and Instrumentation	
Course Code: ETCE/DEMN/S4	Semester: Fourth
Duration: One Semester (Teaching–15 Weeks + Internal Exam-2 weeks)	Maximum Marks: 100 Marks
Teaching Scheme:	**Examination Scheme:**
Theory: 3 contact hrs./ week	Class Test (Internal Examination): 20 Marks
Practical: 2 contact hours/week	Attendance = 10 marks and Quizzes/Assignment/Student Activity = 10 marks
	EndSemesterExamination:60Marks
Credit: 4(TH:3+PR:1)	Practical: 100 Marks

Course Outcomes:

After successful completion of this course the students will be able to

- Familiar with the basics of Measurements, measuring instruments like electronic voltmeter, Multimeter, Q-meter, CRO, signal generator, spectrum analyzer etc.
- Measure unknown parameters using different types of AC and DC Bridges
- Develop the knowledge of TRANSDUCER and POTENTIOMETER

Content (Name of topic)		Periods
Group-A		
Unit 1	**BASICS OF MEASUREMENTS**	**4**
	1.1 Explanationofaccuracy,precision,sensitivity,resolution,Dynamicrange,response andrepeatabilityofmeasuringinstruments 1.2 Units in measurements and different types of units, Definition of Errors and type of errors, Concept of Calibration	
Unit 2	**TYPES OF DC & AC BRIDGES**	**6**
	2.1 DC Bridges – Wheatstone and Kelvin Double Bridge and its application 2.2 AC Bridges - Maxwell's Bridge, Hay's Bridge, Wien Bridge and its application	
Unit 3	**TRANSDUCER and POTENTIOMETER**	**8**
	3.1 Working Principles and Application including Classification, Selection Criteria, Characteristics, Construction of following Transducers- RTD, Thermocouple, Thermistor, LVDT, Strain Gauge, Load Cell Piezoelectric Transducers. 3.2 DC and AC Potentiometer -Basic DC slide wire Potentiometer, Crompton's DC Potentiometer and the applications of DC Potentiometer. 3.3 AC Potentiometers and its applications.	
Unit4	**MEASURING INSTRUMENTS**	**5**
	Working principle and construction of- 4.1 Permanent Magnet Moving Coil Instruments (PMMC). 4.2 Moving Iron type Instruments (MI). 4.3 Electro Dynamo Type Instruments. 4.4 Single Phase Energy Meter.	
Group–B		
Unit 5	**ELECTRONIC INSTRUMENTS**	**10**
	Basics and working principle of - 5.1 Analog and Digital Ammeter, Voltmeter and Multimeter 5.2 Different types of DMM: Integration and successive approximation type. 5.3 Advantages of DMM over Analog MultiMeter. 5.4 Q-Meter. 5.5 Vector Impedance Meter. 5.6 Spectrum Analyzer. 5.7 Function Generator.	
Unit 6	**CATHODERAYOSCILLOSCOPE**	**12**
	6.1 Block diagram of CRO, CRT- constructional features, principle of operation screens, graticules 6.2 Block schematic description of: Vertical Amplifier, (b) Time Base Generator, (c) Trace Synchronization, (d) Triggering Modes, (e) Front Panel Controls, (f) Probe Characteristics (Structure of 1:1 and 10:1 probe). 6.3 Features of dual trace oscilloscopes, chopper beam switch, alternate beam switch.	

	6.4 Block schematic description of digital storage oscilloscope. 6.5 Measurement of amplitude, frequency, time period, phase angle, modulation index (trapezoidal method) and delay time by CRO.	
	TOTAL	**45**

Sl. No.	**Suggested List of Laboratory Experiments**
1.	To study the operation of **:** (a)Multimeter (b) Function Generator (c) PMMC (d) Single Phase Energy Meter.
2.	Measure unknown inductance using following bridges (a) Wheatstone Bridge (b) Maxwell Bridge.
3.	Measurement of displacement with the help of LVDT.
4.	Measurement of strain/force with the help of strain gauge load cell.
5.	Draw the characteristics of the following temperature transducers (a) RTD (Pt-100) (b) Thermistor.
6.	Calibrate a single-phase energy meter by phantom loading.
7.	Calibrate a voltmeter using Crompton potentiometer.
8.	Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes.
9.	Study the working of Q-meter and measure Q of coils.
10.	To study the spectrum analyzer.

References:

Sl. No.	Name of the Author	Title of the Book	Name of the Publisher
1.	Kalsi	Electronic Instrumentation	Tata McGraw-Hill
2.	A.K.Sawhney	A Course in Electrical and Electronic Measurement and Instrumentation	Dhanpat Rai & Sons
3.	David Bell	Electronic Instrumentation and Measurement	Oxford University Press
4.	RK Rajput	Electronics Measurements & Instrumentation	S Chand
5.	Oliver Cage	Electronic Measurement and Instrumentation	McGraw Hill
6.	Wolf and Smith	Students Reference Manual for Electronic Instrumentation Lab	Prentice Hall of India
7.	JB Gupta	Electrical & Electronics Measurement	SK Kataria & Sons
8.	Brownes	Digital Instruments	Tata McGraw Hills

9.	U Sinha	Electrical & Electronics Measurements and Instrumentation	
10.	Cooper	Electronic Measurement and Measurement Technique	Prentice Hall of India

Suggested Scheme of Question Paper for End Semester Examination: [Duration 3 hours]

A: Multiple Choice Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
A1	**1,2, 3&4**	**08**		
A2	**5 & 6**	**07**	**10**	**10x01=10**
	Total:	**15**	**10**	**10**
B: Fill-in the Blank Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
B1	**1,2, 3&4**	**08**		
B2	**5 & 6**	**07**	**10**	**10x01=10**
	Total:	**15**	**10**	**10**
C: Short Answer Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
C1	**1,2, 3&4**	**08**		
C2	**5 & 6**	**07**	**10**	**10x01=10**
	Total:	**15**	**10**	**10**
			Sub-Total[A+B+C]:	**30**
D: Subjective Type Questions (Carrying 2 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
D1	**1,2, 3&4**	**05**		
D2	**5 & 6**	**05**	**06**	**06x02=12**
	Total:	**10**	**06**	**12**
E: Subjective Type Questions (Carrying 6 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
E1	**1,2, 3&4**	**05**		
E2	**5 & 6**	**04**	**03**	**06x03=18**
	Total:	**09**	**03**	**18**
			Sub-Total[D+E]:	**30**
			Total[A+B+C+D+E]:	**60**

Name of the course: Digital And Microwave Communication Systems	
Course Code: ETCE/DMC/S4	Semester: Fourth
Duration: One Semester (Teaching-15 Weeks + Internal Exam-2 weeks)	Maximum Marks: 100 Marks
Teaching Scheme:	**Examination Scheme**
Theory: 3 contact hrs./ week	Class Test(Internal Examination): 20 Marks
Practical: 2 contact hours/week	Attendance=10 marks and Quizzes/Assignment/Student Activity=10 marks
	End Semester Examination: 60 Marks
Credit: 4(TH:3+PR:1)	Practical: 100 Marks

Course Outcomes:

On completion of the course students will be able to :

- Develop the knowledge of further study on digital communication
- Prepare them for work in modern upcoming advanced communication systems
- Increase their skill in the field of microwave communication

Content (Name of the topic)		Periods
Group– A		
Unit 1	**PCM and Delta modulation System**	**07**
	1.1 Basic concept of PCM system – Sampling – Quantizing – Encoding 1.2 Block schematic description of Transmitter and Receiver of PCM system 1.3 Principle of uniform and non-uniform quantization – Companding - signal to quantization noise ratio analysis of linear and nonlinear quantizer 1.4 Block schematic diagram of Delta modulation technique 1.5 Limitations of Delta modulation – Slope overload and Granular noise, Concept of Adaptive Delta Modulation	
Unit 2	**Digital modulation techniques**	**10**
	2.1 RF Modulation for base band signal – Geometric representation of signals 2.2 Basic idea of Maximum likelihood decoding 2.3 Generation, detection and waveform of ASK, BPSK, coherent and non-coherent FSK, QPSK and DPSK, comparison of bandwidth and bit rate of digital modulation scheme. 2.4 QAM, MSK and multicarrier modulation – comparison of bandwidth and bit rate of digital modulation scheme.	
Group– B		
Unit3	**Multiplexing**	**10**

	3.1 Idea of multiplexing and its necessity 3.2 Types of multiplexing – Time division multiplexing – Frequency division multiplexing – Code division multiplexing 3.3 Principles of Time division multiplexing and synchronization in a digital communication system 3.4 PCM – TDM in modern applications 3.5 Frequency division multiplexing with practical examples	
Unit 4	**Spread Spectrum Modulation**	**06**
	4.1 Introduction to PN sequence 4.2 Model of spread spectrum modulation 4.3 Direct sequence spread spectrum (DSSS) 4.4 Frequency hop spread spectrum (FHSS) – Slow frequency hopping and Fast frequency hopping 4.5 Application of spread spectrum modulation	
	Group– C	
Unit 5	**Microwave Communication**	**12**
	5.1 Problems associated with conventional tubes at microwave frequency 5.2 Basic idea of amplification with velocity and density modulation – multi cavity Klystron – Reflex Klystron – Travelling Wave Tube (TWT) with efficiency, power output and frequency range of operation – field of application 5.3 Principle operation of GUNN and IMPATT and their field of operation 5.4 Detectors used at microwave frequency –detector diode 5.5 Microwave passive devices – Directional coupler – Attenuator – Isolator – Magic Tee 5.6 Basic idea – Rectangular waveguide, Circular waveguide 5.7 Concept of Propagation of EM wave through waveguide with TE and TM modes.	
	Total	**45**

Sl. No.	**Suggested List of Laboratory Experiments**
1	To study generation of TDM signal and the detected waveforms
2	To study generation of FDM signal and the detected waveforms
3	To study generation of ASK signal and the detected waveforms
4	To study generation of FSK signal and the detected waveforms.
5	To study generation of PSK signal and the detected waveforms
6	To study the characteristics of GUNN diode
7	To study the characteristics of KLYSTRON
8	To study the characteristics of Directional Coupler
9	To study the characteristics of Attenuator
10	To study the characteristics of Isolator

11	To study the characteristics of Magic Tee
12	Mini projects on (A) TDM transmitter (B) TDM receiver (C) FDM transmitter (D) FDM receiver

References:

Sl No.	Name of the Author	Title of the Book	Name of the Publishers
1.	Taub Schilling	Principles of communication systems	T.M.H
2.	Simon Haykin	Communication Systems	Wiley
3.	B.P. Lathi	Modern Digital & Analog Communication	Oxford Publications
4.	Dr. Sanjay Sharma	Communication Systems (Analog and Digital)	S. K. Kataria & Sons
5.	Wayne Tomasi	Advanced Electronic Communication System	P. H. I.
6.	Kennedy, Devis	Electronic Communication Systems	T.M.H.
7.	Frenzel	Electronics Communication	T.M.H.

Suggested Scheme of Question Paper for End Semester Examination: [Duration 3 hours]

A: Multiple Choice Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
A1	**1&2**	**06**	**10**	**10x01=10**
A2	**3&4**	**05**		
A3	**5**	**04**		
	Total:	**15**	**10**	**10**
B: Fill-in the Blank Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
B1	**1&2**	**06**	**10**	**10x01=10**
B2	**3&4**	**05**		
B3	**5**	**04**		
	Total:	**15**	**10**	**10**
C: Short Answer Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
C1	**1&2**	**06**	**10**	**10x01=10**
C2	**3&4**	**05**		
C3	**5**	**04**		
	Total:	**15**	**10**	**10**
			Sub-Total[A+B+C]:	**30**
D: Subjective Type Questions (Carrying 2 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
D1	**1&2**	**04**	**06**	**06x02=12**
D2	**3&4**	**04**		
D3	**5**	**02**		
	Total:	**10**	**06**	**12**
E: Subjective Type Questions (Carrying 6 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
E1	**1&2**	**03**	**03**	**06x03=18**
E2	**3&4**	**03**		
	5	**03**		

Total:	**09**	**03**	**18**
		Sub-Total[D+E]:	**30**
		Total[A+B+C+D+E]:	**60**

West Bengal State Council of Technical & Vocational Education and Skill Development
(Technical Education Division)

Syllabus
of

Diploma in Electronics & Communication Engineering [ECE] & Electronics & Tele-Communication Engineering [ETCE]

Part-III (5th Semester)

Revised 2022

Further suggestion may be submitted to the syllabus committee. List of the coordinators for the branch of Diploma in Electronics & Tele Communication Engineering are:

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WEST BENGAL STATE COUNCIL OF TECHNICAL EDUCATION											
TEACHING AND EXAMINATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES											
COURSE NAME: FULL TIME DIPLOMA IN ELECTRONICS & TELECOMMUNICATION ENGINEERING											
DURATION OF COURSE: 6 SEMESTERS											
SEMESTER: FIFTH											
BRANCH: ELECTRONICS & TELECOMMUNICATION ENGINEERING											
SR. NO.	SUBJECT	CREDITS	PERIODS		EVALUATION SCHEME						
			L	PR	THEORETICAL				PRACTICAL		Total Marks
					TA	CT	Total	ESE	Internal	External	
1.	Embedded Systems	3	3	-	20	20	40	60	-	-	100
2.	Advanced Communication System	3	3	-	20	20	40	60	-	-	100
3.	Industrial Electronics Or Medical Electronics	3	3	-	20	20	40	60	-	-	100
4.	Internet of Things Or Mobile Communication	3	3	-	20	20	40	60	-	-	100
5.	Embedded Systems Lab	1	-	2	-	-	-	-	60	40	100
6.	Advanced Communication System Lab	1	-	2	-	-	-	-	60	40	100
7.	Industrial Electronics Lab Or Medical Electronics Lab	1	-	2	-	-	-	-	60	40	100
8.	Hands on Internet of Things Or Mobile Communication	1	-	2	-	-	-	-	60	40	100
9.	Project	2	-	4	-	-	-	-	60	40	100
10.	Internship-II	1	-	-	-	-	-	-	100	-	100
	Total	19	12	12	80	80	160	240	400	200	1000

- **STUDENT CONTACT HOURS PER WEEK: 24 hours**
- **ACADEMIC CONTACT WEEKS PER SEMESTER : 17 weeks (Teaching-15 weeks + Internal Exam-2 weeks)**
- **THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH**
- **ABBREVIATIONS: L- Lecture, PR- Practical, IA- Internal Assessment, CT- Class Test, ESE- End Semester Exam**
- **IA (Internal Assessment for Theoretical) = 40 marks: CT= 20 Marks, Attendance =10 marks and Quizzes/Assignment/Student Activity = 10 marks.**
- **Minimum qualifying marks for both Theoretical and Sessional subjects (for internal assessment and external assessment separately) are 40%.**
- **IA (Internal Assessment for Practical) =60 marks: 50 marks for continuous evaluation and 10 marks for Class attendance.**
- **Internship-II will be completely assessed internally.**

Name of the course: Embedded Systems	
Course Code: ETCE/DEMS/S5	Semester: Fifth
Duration: One Semester (Teaching-15 Weeks + Internal Exam-2weeks)	Maximum Marks:100 Marks
Teaching Scheme:	**Examination Scheme:**
Theory: 3contact hrs./week	Class Test(Internal Examination):20 Marks
Practical:2contact hours/week	Attendance=10 marks and Quizzes/Assignment/Student Activity= 10 marks
	End Semester Examination:60 Marks
Credit:4(TH:3+PR:1)	Practical:100 Marks

Course Outcomes:

- Students will acquire knowledge on the function and area of application of Arduino and PIC 18 Microcontroller based embedded systems used in modern electronics control and Artificial Intelligence Systems.
- Students will have a clear idea of basic function, characteristic and application of Embedded C Software in the modern embedded systems.
- Students will be able to build small Arduino & PIC 18 Microcontroller based project based on real life applications.

	Content(Name of the topic)	Periods
	Group–A	
Unit 1	**Embedded System Design Basics**	**03**
	1.1 Introduction to embedded systems. 1.2 Components of embedded system. 1.3 Comparison among 8051, Arduino and PIC	
Unit 2	**Architecture review of Arduino Uno board**	**10**
	2.1 Introduction to ARDUINO, ARDUINO History and Family- Mega, Nano, Bluetooth, Lilypad. 2.2 Pin configuration and architecture Of ATmega328 microcontroller 2.3 Study of an Arduino Board- Power Supply, Power Connectors, Analog Inputs, Digital Connections, crystal oscillator, Reset switch, Serial Programming Connector etc. 2.4 Concept of digital and analog ports. 2.5 General Hardware Interfacings: • LED's • Switches • Seven Segment Display • Multi Segment Displays • Relays (AC Appliance Control) • LCD • Buzzer	
	Group–B	
Unit 3	**Embedded C programming simulation model for Arduino**	**10**
	3.1 Introduction to Embedded C and steps to install Arduino Integrated development platform. 3.2 Basic commands for Arduino Functions, Parameters, Variables- Global, local and static, Numeric variables-Int, Float, Boolean, # Define directives, Looping statements-if, for, while, Logical Operators, Mathematical operators, Return values, Coding styles – Indentation, opening Braces, Whitespace, Comments, Arrays and strings, Morse code translator, Pinmode- to configure the Digital and Analog pins as Input or Output pin, Standard Arduino library- Random number, Math function, bit manipulation, Advanced I/O, Interrupts, storing a Integer, Float and string data types in EEPROM, Clearing the	

	contents of EEPROM, Range compression, Arduino Ethernet programming, Programming with Arduino IDE, Compiling and Debugging using IDE 3.3 Proteus simulation model for Arduino	
Unit 4	**PIC 18 Architecture and its programming**	**10**
	4.1 PIC 18 architecture and assembly level programming a) The WREG register in PIC b) PIC file register c) Using instruction with the default access bank d) Status register e) PIC data format and directives f) Branch, call and time delay loop 4.2 Proteus simulation model for PIC 4.3 PIC I/O port programming 4.4 ADC programming	
	Group–C	
Unit 5	**I/O interfacing , Programming and Simulation model**	**12**
	5.1 LED interfacing with Arduino /PIC - Circuit diagram, program for LED blinking, Proteus simulation model 5.2 2Single switch and seven segment interface with Arduino /PIC - Circuit diagram, program for increment digit, Proteus simulation model 5.3 Sensors (Temperature, Light, Proximity) and LED/LCD interface with Arduino /PIC- Circuit diagram, program, Proteus simulation model 5.4 Interfacing with DC motor with Arduino /PIC –speed control program with direction change: Circuit diagram, program, Proteus simulation model 5.5 Interfacing with Stepper motor with Arduino /PIC –speed control program with direction change: Circuit diagram, program, Proteus simulation model	
	Total	**45**

Sl.No.	**Suggested List of Laboratory Experiments**
1	Installation of Arduino software from the website www.arduino.cc.
2	Installation software From MPLAB IDE and MPLAB XC from microchip website.
3	Installation of Proteus software for simulation purpose.
4	Built-in LED state control by push button sketch implementation (Arduino /PIC)
5	Built-in LED blinking sketch implementation (Arduino /PIC)
6	Built-in LED blinking by toggling states based on binary operation (Arduino /PIC)
7	Controlling multiple LEDs with a loop and an array (Arduino /PIC)
8	Use a potentiometer to control the blinking of an LED (Arduino /PIC)
9	Temperature monitor using LCD display and LM35 (using Adrino /PIC)
10	Light sensor interfacing and sending its reading using I2C Communication Protocol (using Arduino /PIC)
11	Servo Motor Control using PWM(Arduino /PIC)
12	Mini projects on 1. Home automation. (Arduino /PIC) 2. Solar Street Light system. (Arduino /PIC) 3. Clock. (Arduino /PIC)

	4. Solar charge controller(Arduino /PIC) 5. RTC clock(Arduino /PIC)

Software(s) required: 1. Arduino Integrated Development Environment Software. 2. Free software MPLAB IDE and MPLAB XC are available in microchip website. 3. Proteus software can be used for simulation purpose.

Hardware(s) required: 1. ARDUINO UNO R3 Board with USB Cable
• Microcontroller ATmega328 • Operating Voltage: 5V • Input Voltage (Recommended): 7-12V • Digital I /O Pins- 14 (of which 6 provide PWM output) •Analog I/O pins-6, Flash memory 32 KB (ATmega328) of which 0.5 KB used by bootloader ,SRAM 2 KB (ATmega328) , EEPROM –1KB , Clock Speed 16 MHz , Both 5V and 3.3 V power rails, Proper Indicator LED's, Power jack and USB connection., Breadboard Compatibility (dimension of a 40 pin DIP IC).
2. PIC kit 3.5+ In-Circuit Debugger/Programmer compatible to Microchip uses in-circuit debugging logic incorporated into each chip with Flash memory to provide a low-cost hardware debugger and programmer. The PIC kit 3.5+ allows debugging and programming of PIC and dsPIC Flash microcontrollers using the powerful graphical user interface of the MPLAB Integrated Development Environment (IDE).

References:

Sl No.	Title of Book	Author	Publication
1.	Arduino-Based Embedded Systems	Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury	Taylor& Francis
2.	Embedded C	Pont, Michael J	Addison- Wissley professional
3.	Getting Started with Arduino: The Open Source electronic prototyping platform	Massimo Banzi	Shroff Publishers & Distributors Pvt Ltd, 2014
4.	Programming Arduino: Getting Started with Sketches	Simon Monk	McGraw-Hill Education, Second Edition,2016
5.	Arduino Cookbook	Margolis	Shroff/O'Reilly Publication, 2nd edition 2012
6.	Embedded Systems	Himanshu Dave, Parag Dave	Pearson (ISBN: 9789332543522)
7.	Arduino Made Simple	Ashwin Pajankar	
8.	PIC Microcontroller and Embedded systems using Assembly and C for PIC18	M.A.Mazidi, R.D. Mckinlay and D. Causey	Pearson
9.	The Essential PIC 18 Microcontroller	Sid Katzen	Springer
10.	Fundamentals of Microcontrollers and Applications in Embedded system (with the PIC 18 microcontroller family)	R. Gaonkar	Penram International Publishing

Resources:

1. https ://www.arduino.cc/en/Tutorial/HomePage
2. www.microchip.com
3. www.pictutorials.com

Name of the course: Advance Communication System	
Course Code: ETCE/DACS/S5	Semester: Fifth
Duration: One Semester(Teaching-15 Weeks + Internal Exam-2weeks)	Maximum Marks:100 Marks
Teaching Scheme:	**Examination Scheme**
Theory: 3contact hrs./week	Class Test(Internal Examination):20 Marks
Practical:2contact hours/week	Attendance=10 marks and Quizzes/Assignment/Student Activity= 10 marks
	End Semester Examination:60 Marks
Credit:4(TH:3+PR:1)	Practical:100 Marks

Course Outcomes:

- Students will acquire knowledge on the purpose, requirement and function and area of application of wireless telecommunication at different frequency band used in modern communication system.
- Students will have a clear idea of basic function, characteristic and application of different types of Antenna used in wireless telecommunication system.
- Students will able to know how to work in the field of optical communication system.

Content(Name of the topic)		Periods
	Group–A	
Unit 1	**Satellite Communication**	**07**
	1.1 Kepler's Law – Orbital period and Satellite speed – Types of orbits – polar – inclined – equatorial – LEO – MEO – GEO – Station keeping – Satellite Launching process – Attitude control 1.2 Transponder- Frequency allocation – Frequency reuse 1.3 Function of Communication Satellite with block diagram 1.4 Principles of FDMA and TDMA and their use in Satellite communication.	
Unit 2	**RADAR Systems**	**06**
	2.1 Principle operation of RADAR – PPI – Duplexer – RADAR range – Frequency and Power range of RADAR 2.2 Function of Pulsed RADAR – Function of MTI – Doppler effect – Blind speed	
	Group–B	
Unit 3	**Mobile Communication and modern wireless communication system**	**12**
	3.1 Overview of cellular system – 2G, 3G, 4G and 5G concept – Frequency reuse – location update and call setup – Hand off and power control 3.2 Block diagram and operation of mobile (hand set) unit – Frequency synthesizer – Transmitter unit – Receiver unit – Logic unit – Control unit 3.3 Mobile Base Station – Mobile Control Station 3.4 Digital cellular system – GSM architecture – protocol – security aspect 3.5 Modern wireless Network – Universal mobile telecommunication service (UMTS) –	

	LTE – CDMA – SCDMA – Wireless local loop (WLL) – Local multipoint distribution service (LMDS) technology 3.6 Concepts of Blue-tooth, Wi-Fi and Wi-max	
Unit 4	**Antenna**	**08**
	4.1 Basic principle of Antenna – Characteristic and features of different Antenna – Dipole – Half wave dipole – folded dipole – horn antenna – dish antenna – parabolic antenna – array antenna – Yagi-Uda antenna – their application and use. 4.2 Properties of antenna – Gain – Bandwidth – beam width – impedance – radiation pattern of different antenna (Dipole, half and full wave dipole, half and full wave folded dipole)	
	Group–C	
Unit 5	**Optical communication system**	**12**
	5.1 Basic principle of fiber optic communication system – advantage and limitations of optical fiber communication - Construction of optical fiber – types of fibers – mono mode – multimode – step index and graded index 5.2 Optical fiber performances – bandwidth distance product – Transmission Losses 5.3 Optical Sources – LED – LASER – Modulation of LED and LASER – Function and principle operation of optical detectors – Photo diode – PIN – photo transistor – APD 5.4 Components of optical fiber – coupler – connector – splices 5.5 Block diagram of optical fiber communication system and its operation – basic idea of fiber optic networking 5.6 Fiber distributed Data Interface (FDDI) – Synchronous optical network (SONET) 5.7 Multiplexing of optical signals – WDM – OFDM. 5.8 Application of SS Modulation	
	Total	**45**

Sl. No.	**Suggested List of Laboratory Experiments**
1	To study the function of fiber optic analog link
2	To study the frequency response of optical receiver at various load conditions
3	To study the propagation loss in optical fiber
4	To study the bending loss in optical fiber.
5	To study the numerical aperture of optical fiber
6	To study the radiation pattern and to obtain the polar plot of half wave dipole antenna, full wave dipole antenna, folded dipole antenna and Yagi-Uda antenna.
7	To set up a satellite communication link and study of change in uplink and downlink frequency
8	To establish an Audio-Video satellite link between transmitter and receiver
9	To find the maximum range of RADAR (using simulation software)
10	To study the behavior of the CDMA Direct sequence Spread spectrum modulation and demodulation.
11	To study and analyze the Mobile Phone.

12	Mini projects on (A) To design an optical fiber link (B) To develop any control system using optical source and detectors (C) To develop a voice communication link using optical fiber (D) FM transmitter

References:

Sl No.	Title of Book	Author	Publication
1.	Principles of communication systems	Taub Schilling	T.M.H
2.	Communication Systems	Simon Haykin	Wiley
3.	Modern Digital & Analog Communication	B.P. Lathi	Oxford Publications
4.	Communication Systems (Analog and Digital)	Dr. Sanjay Sharma	S. K. Kataria& Sons
5.	Advanced Electronic Communication System	Wayne Tomasi	P. H. I.
6.	Electronic Communication Systems	Kennedy, Devis	T.M.H.
7.	Electronics Communication	Frenzel	T.M.H.
8.	Wireless Communications – Principles and Practice	T. S. Rappaport	Pearson
9.	Modern Wireless Communications	Haykin And Mother	Pearson

Name of the course: Internet of Things	
Course Code: ETCE/DIoT/S5	Semester: Fifth
Duration: One Semester(Teaching-15 Weeks + Internal Exam-2 weeks)	Maximum Marks:100 Marks
Teaching Scheme:	**Examination Scheme**
Theory:3contact hours/ week	Class Test(Internal Examination):20 Marks
Practical:2contact hours/week	Attendance=10 marks and Quizzes/Assignment/Student Activity=10 marks
	End Semester Examination: 60 Marks
Credit:4(TH:3+PR:1)	Practical:100 Marks

Course Outcomes:

On completion of the course students will be able to:

- Understand the concept of Internet of Things
- Explore on use of various hardware and sensing technologies to build IoT applications
- Illustrate the architecture of Internet of Things and python
- Understand the working with python on Arduino and Raspberry Pi

Content(Name of the topic)		Periods
Group – A		
Unit 1	**Introduction to Internet of Things**	**07**

	1.1 Introduction to Internet of Things, Define the term “Internet of Things”. 1.2 Essential blocks of an IoT system, along with explanation. 1.3 Detail architecture of an IoT system. 1.4 Necessity of embedded system into the IoT	
Unit 2	**Sensors, Actuators and Networking involved in IoT**	**11**
	2.1 Need of Sensors and actuators involved in IoT systems. 2.2 Basic aspects of the networking involved in Internet of Things (MQTT, CoAP), Basic idea on Communication Protocols (like Zigbee, Bluetooth etc.) and Sensor networks (like WSNs).	
	Group – B	
Unit 3	**Basics of Python programming**	**10**
	3.1 Importance of Python based programming in IoT development platforms compare to others programming languages, Basics of Python programming, Idea on Python IDE (Spyder). 3.2 Printing statement with indentation, data-types (Numbers, String, List, Tuple, Dictionary), Controlling statements (if-elif-else, while, for, break, continue) 3.3 Definition of function (without return value, with return value), Calling of function with examples, Functions as Objects (with examples), Variables (Global, Local) with examples, Modules with examples, Exception Handlers with examples 3.4 File read/write operations (Open, Read/Write, Close) with examples, Image read/write operations, network services for client server model	
Unit 4	**IoT development with different platforms (Arduino, Raspberry Pi)**	**11**
	4.1 Study of Arduino board and its interfacing (using Python programming) 4.2 Importance of Raspberry Pi in the development of IoT (compare to Arduino). Basic Architecture, Pin details, Installation and configuration, Applications of Raspberry Pi. 4.3 Implementation of IoT with Raspberry Pi (Read data from sensor and sending data to a server)	
	Group – C	
Unit 5	**IoT applications in Agriculture, Healthcare and Activity Monitoring**	**06**
	5.1 Smart Water Management System using IoT: Architecture and design 5.2 Remote Healthcare System, Real-time monitoring and Preventive care system : Architecture and design 5.3 Smartphone based activity monitoring system : Architecture and design	
	Total	**45**

Sl. No.	**Suggested List of Laboratory Experiments**
1	Establish an MQTT connection in order to communicate with the server over the MQTT protocol.
2	Publish and subscribe data by MQTT Client
3	Installation of Python IDE (Spyder), use of editor and console separately, Python distribution using anaconda.
4	Implementation of printing and controlling statements.
5	Implementation of data-types, variables, functions, modules.

6	Python programming with Arduino
7	Installing Raspbian OS, Familiarizing with Raspberry Pi Components and interface, Connecting to Ethernet, Monitor, USB
8	Displaying different LED patterns with Raspberry Pi
9	Interface sensor and Actuator with Raspberry Pi
10	IoT based Web Controlled Home Automation using Raspberry Pi
11	Mini Project

References:

Sl No.	Title of Book	Author	Publication
1.	Internet of Things: Architecture and Design Principles	Raj Kamal	McGraw Hill Education; First edition (10 March 2017) ISBN 978-9352605224
2.	IoT Fundamentals, 1e	Hanes	Pearson (ISBN: 9789386873743)
3.	The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World	Miller	Pearson (ISBN: 9789332552456)
4.	Internet of Things	Ramgir	Pearson (ISBN: 9789353438944)
5.	internet of Things: A Hands-On Approach	Arsheep Bahge and Vijay Madisetti	Orient Blackswan Private Limited - New Delhi; First edition (2015) ISBN : 978-8173719547
6.	Internet of Things	Dr. Jeeva Jose	Khanna Publishing House (Edition 2017)
7.	The Internet of Things: Enabling Technologies, Platforms, and Use Cases	Pethuru Raj and Anupama C. Raman	CRC Press

Resources:

1. https://www.raspberrypi.org/blog/getting-started-with-iot/
2. https://www.arduino.cc/en/IoT/HomePage
3. https://www.microchip.com/design-centers/internet-of-things
4. https://learn.adafruit.com/category/internet-of-things-iot
5. https://nptel.ac.in/noc/individual_course.php?id=noc17-cs22
6. Research papers

Name of the course: Mobile Communication	
Course Code: ETCE/DMC/S5	Semester: Fifth
Duration: One Semester(Teaching-15 Weeks + Internal Exam-2 weeks)	Maximum Marks:100 Marks
Teaching Scheme:	**Examination Scheme**
Theory:3contact hours/ week	Class Test(Internal Examination):20 Marks
Practical:2contact hours/week	Attendance=10 marks and Quizzes/Assignment/Student Activity=10 marks
	End Semester Examination: 60 Marks
Credit:4(TH:3+PR:1)	Practical:100 Marks
Course Outcomes:	

On completion of the course students will be able to:

- State about Basic Terminologies and functions of mobile Communication system
- Analyze the Progression of Cellular Telephone System
- Explain about GSM, GPRS, PCSS and EDGE
- Describe the concept of Antennas used in mobile Communication system

Content(Name of the topic)		Periods
Group – A		
Unit 1	**FUNDAMENTAL OF MOBILE COMMUNICATION**	**10**
	1.1 Personal communication system -Wireless local area network -Wireless broadband access system- Wireless wide area network. 1.2 Basic Terminologies related to Cellular Communication: Mobile Station, Base Station, Control channel, Forward and reverse channel, MSC, MTSO, PSTN. 1.3 Basic Cellular Communication Architecture. 1.4 Initialization of Cellular Calls between Mobile Station to Mobile Station, and Landline Phone to Mobile Station - Timing Diagrams illustrating how a call initiated by a mobile and landline phone users.	
Unit 2	**CELLULAR CONCEPTS**	**10**
	2.1 Features of Cellular system - shapes of cell, Frequency reuse, Co-channel interference - Adjacent channel interference - Cell splitting -Sectoring -Segmentation and Dualization. 2.2 Concept of Roaming and Hands-off Strategies, Call drop and avoidance strategies. 2.3 Types of hands-off Strategies: Hard Hands-off -Soft Hands-off- Mobile assisted hands-off.	
Unit 3	**CELLULAR TELEPHONE SYSTEM**	**10**
	3.1 Features of 1st Generation Analog cellular Telephone- AMPS Frequency allocation. 3.2 Features of 2nd Generation Cellular Telephone System – Basic ideas of N-AMPS and Digital Cellular Telephone-Advantages of 2G over 1G. 3.3 Features of 3rd Generation Cellular Telephone System - Advantages of 3G over 2G 3.4 Features of 4th Generation Cellular Telephone System- Features of LTE & VOLTE and their difference – features of WIMAX-Application of 4G- Advantages over 4G over 3G. 3.5 Features of 5thGeneration Cellular Telephone System –Application of 5G- Advantages over 5G over 4G.	
Group – B		
Unit 4	**Global System For Mobile Communication (GSM)**	**09**
	4.1 Features of GSM services. 4.2 GSM Architecture: Mobile Station-Base Station Subsystem (BTS, BSC)-Networking Switching Subsystem(HLR, MSC, VLR,AUC,EIR)-Operational support subsystem. 4.3 General Packet Radio System (GPRS): Concept -Services offered –benefits. 4.4 Idea of Enhanced Data rates for Global Evolution (EDGE) 4.5PCSS (Personal Communication Satellite system) –Basic concept, Advantages and disadvantages.	
Unit 5	**Antenna used in mobile Phone**	**06**
	5.1 Working principle of Mobile Phone Antenna –Working of PIFA (Planar Inverted F Antenna) –Location of antenna in mobile set 5.2 selection of antenna for reducing SAR (Specific Absorption Rate), Microstrip Antenna. 5.3 Antenna Used in Mobile Tower - Types and features	
	Total	**45**

Sl. No.	Suggested List of Laboratory Experiments
1	To study Cellular Fundamentals like Frequency Reuse, Interference, cell splitting, Base Station, Control channel, Forward and reverse channel, MSC, MTSO, PSTN (by using virtual lab).
2	Study of GSM handset for various signalling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).
3	To study transmitters and receiver sections in mobile handset and measure frequency band signal.
4	Demonstrate the impact the received power levels for hand-off in case of mobile cellular communication using fading channel mobile communication virtual lab.
5	Estimate the impact of sectoring in increasing cellular system capacity using fading channel mobile communication virtual lab.
6	Study the GPRS system and use it for sending an e-mail through WI-GPRS trainer.
7	Study the GSM modem and its different module for phone book, setting up a call, sending SMS and identifying call history using AT commands.

References:

Sl No.	Title of Book	Author	Publication
1.	Wireless Communications Principles and Practice	Theodore S. Rappaport	2nd Edition, Pearson Education, 2003
2.	Mobile Wireless Communication	Mischa Schwartz	Cambridge publication
3.	Mobile Communications	Jochen Schiller	2nd Edition, Pearson Education
4.	Principle and Application of GSM	V.K.Garg, J.E.Wilkes	Pearson Education, 5th edition
5.	Wireless Digital Communications	Kamilo Feher	PHI, 2003
6.	Mobile Cellular Communications	W.C.Y. Lee	2nd Edition, MC Graw Hill, 1995
7.	Mobile Communication Paperback – 1 January 2013	Brijesh Verma	

Resources:

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

Name of the course: Industrial Electronics	
Course Code: ETCE/DIE/S5	Semester: Fifth
Duration: One Semester(Teaching-15 Weeks + Internal Exam-2 weeks)	Maximum Marks:100 Marks
Teaching Scheme:	**Examination Scheme**
Theory:3contact hours/ week	Class Test(Internal Examination):20 Marks
Practical:2contact hours/week	Attendance=10 marks and Quizzes/Assignment/Student Activity=10 marks
	End Semester Examination: 60 Marks
Credit:4(TH:3+PR:1)	Practical:100 Marks
Course Outcomes:	

On completion of the course students will be able to:

- Interpret the performance of different types of Power Semiconductor Devices
- Implement different types of controlled rectifiers
- Compare the performance of different types of Power Supply
- Analyze the operation of various converters, inverters, choppers, regulators etc.
- Illustrate the speed control methods of different types of motors.

Content(Name of the topic)		Periods
	Group – A	
Unit 1	**Power Semiconductor Devices**	**06**
	1.1 Principle of operation, VI characteristic and switching characteristics, Applications: Power Diode, Power Transistor, MOSFET and IGBT 1.2 Concept of thermal resistance, heat sink and thermal equivalent circuit 1.3 Concept of protection of Power Semiconductor Devices: MOV and Snubber	
Unit 2	**Thyristor**	**12**
	2.1 Switching characteristics & Two transistors method of SCR, Ratings of SCR 2.2 Triggering circuits of SCR 2.3 Need for series and parallel methods of SCR. Reasons of unequal voltage and current distribution and equalization networks 2.4 Family devices - Photosensitive SCR, GTO, SCS, TRIAC & DIAC 2.5 Commutation circuits of SCR – natural and forced commutation – Class A, B, C, D and Class E	
Unit 3	**Single phase &Polyphase controlled rectifier**	**08**
	3.1 Single phase half wave and full wave control rectifier circuit – Principle of operation with resistive and inductive load – Use of free wheel diode. Calculation of Vdc 3.2 Three phase half wave and full wave control rectifier – Operation with inductive and resistive load. Calculation of Vdc 3.3 Concept of full control and half control rectifier	
	Group – B	
Unit 4	**Application of SCR in Power Supply**	**04**
	4.1 Switching Regulator (SMPS) principle of operation, Block and circuit diagram and PWM control circuit consideration of switching regulator 4.2 Advantage and disadvantage of switching regulator in comparison with linear regulator 4.3 Principle of operation of ON-line UPS and OFF-line UPS	
Unit 5	**Converters**	**10**
	5.1 Chopper - Principle of operation with an example (Jone's chopper) and its application 5.2 Inverters - Voltage source inverter and current source inverter; Single Phase Half bridge and full bridgeinverter; Three phase inverter; Applications of inverters 5.3 Principle of operation of Cycloconverter and its applications 5.4 Dual Converter and its applications 5.5 AC Power Regulators - Phase Control AC Regulator, Sequence Control of AC Regulators	

Unit 6	SPEED CONTROL OF MOTORS	05
	6.1 TYPES OF SPEED CONTROL OF DC MOTOR**:** Armature Voltage Control, Field Current Control, Quadrant Drive 6.2 Types of speed variation of AC Motor- Frequency variation, Stator volt variation	
	Total	**45**

Sl. No.	Suggested List of Laboratory Experiments
1	To measure the reverse recovery time and softness factor of a diode
2	To plot V/I characteristics of SCR
3	To plot V/I characteristics of Triac.
4	To plot V/I characteristics of Diac
5	To study the operation of a triggering circuit of SCR
6	To study the operation of a single phase rectifier—output waveform with phase control circuit
7	To study the operation of a polyphase rectifier
8	To study the operation of SMPS
9	To study the operation of a phase control AC regulator
10	To study the operation of a Jones chopper
11	To study the operation of an Online UPS system
12	To study the operation of a single-phase bridge inverter with resistive load
13	To study the speed control of DC motor by: — (a) varying field current keeping armature voltage constant; and, (b) varying armature voltage keeping field current constant
14	To study speed control of an induction motor by voltage and frequency variation

References:

Sl No.	Title of Book	Author	Publication
1.	Power Electronics	Dr. S K Mandal	TMH
2.	Industrial Electronics	Khan &Chandani	TMH
3.	Industrial Electronics	Biswanath Pal	PHI
4.	Power Electronics	H Babu	Scitech
5.	Power Electronics	Moorthi	OXFORD
6.	Industrial Electronics	S N Biswas	Dhanpat Rai
7.	Modern Power Electronics	P C Sen	S Chand
8.	Power Electronics- Circuits, Devices and Applications	Muhammad H Rashid	Pearson
9.	Industrial Electronics	Chatterjee & Bhattacharya(TTTI)	TMH
10.	Power EllectroniicsConvertter Applliicattiion and Desiign	Mohan	Wiley

Name of the course: Medical Electronics	
Course Code: ETCE/DME/S5	Semester: Fifth
Duration: One Semester(Teaching-15 Weeks + Internal Exam-2 weeks)	Maximum Marks:100 Marks
Teaching Scheme:	**Examination Scheme**
Theory:3contact hours/ week	Class Test(Internal Examination):20 Marks
Practical:2contact hours/week	Attendance=10 marks and Quizzes/Assignment/Student Activity=10 marks
	End Semester Examination: 60 Marks
Credit:4(TH:3+PR:1)	Practical:100 Marks

Course Outcomes:

On completion of the course students will be able to:

- Acquire the knowledge of bio-electric potential
- Familiar with bio-medical Instrumentation
- Introduce the student to the electronic devices and theory of operation in the medical area
- Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits
- Introduce the student to the electronic devices for medical imaging

Content(Name of the topic)		Periods
	Group – A	
Unit 1	**Bio-potential**	**05**
	1.1 Introduction to cell, Structure of cell membrane, excitable cells, definition of Bio-potential, Membrane potential, Resting membrane potential, Cause of Resting membrane potential, Nernst equation for Equilibrium electric potential, Goldman equation for membrane potential, Action potential, Different phenomenon of action potential, action potential wave form, Propagation of action potential. 1.2 Bio-medical signals - Non-electric bio-medical signal and introduction to bio-electric signals & their sources. Introduction to ECG, EEG, EMG, ERG	
Unit 2	**Basic Concept of Bio-medical Instrumentation**	**04**
	2.1 Different types of bio-medical instrument, Generalized bio-medical instrumentation system - Basic block diagram, different functional units such as electrodes, transducer/ sensor, bio-amplifier, filter, display, recorder, alarm, controlling system, memory.	
Unit 3	**ECG**	**06**
	3.1 Definition of ECG, Electro-physiology of heart, ECG amplifier, ECG electrodes and its placement, ECG leads, Basic block diagram of ECG machine, HR measurement	
	Group – B	
Unit 4	**Blood pressure measurement**	**05**
	4.1 definition of blood pressure, arterial blood pressure, Systolic pressure, Diastolic pressure, pulse pressure, mean pressure, Indirect BP measurement method, Principle of Auscultatory method 4.2 Working of Electronic BP instrument, Working principle of Direct BP measurement.	
Unit 5	**Medical Laboratory Instrument**	**04**
	5.1 Introduction to photometry, Bear-Lambert's law. Working, block diagram, application of Colorimeter, Clinical Bio-chemistry analyzer, Cell counter	
Unit 6	**Cardiac Pacemaker and Defibrillator**	**04**

	6.1 Pacemaker & its necessity, Working principle of Synchronous and Asynchronous pacemaker with block diagram, Implantable Pacemaker. Defibrillator, Working principle of Defibrillator with block diagram. Application of Defibrillator	
Unit 7	**Patient Monitoring System**	**03**
	7.1 Introduction to ICU, Working of bed side patient, different clinical parameter, Centralized patient Monitoring system	
Unit 8	**Electro-surgery Machine**	**02**
	8.1 Working principle of electro-surgery machine, Cutting & coagulation mode, Electro-surgery circuit, electro-surgery Safety	
	Group – C	
Unit 9	**Electrical safety**	**04**
	9.1 Introduction to Electric shock hazard in electro-medical Instrument, Macro shock, micro shock, Physiological effects of Electric Shock, Leakage current, Earth leakage current, Enclosure leakage current, Patient Leakage current, Patient safety precaution	
Unit 10	**Medical imaging**	**05**
	10.1 X-ray, Working of X-ray machine with block diagram, Computed radiography (CR) system, Digital radiography (DR), Ultrasound, Working principle of Ultrasound imaging system, Different modes of Ultrasound. Principle of CT image formation, Principle of MRI	
Unit 11	**Introduction to bio-telemetry**	**03**
	11.1 Definition of bio-telemetry, Wireless bio-telemetry, Single channel bio-telemetry, Multi-channel Bio-telemetry	
	Total	**45**

Sl. No.	**Suggested List of Laboratory Experiments**
1	Study of ECG amplifier circuit.
2	Recording of ECG
3	Study of electronic BP instrument circuit.
4	Blood Pressure measurement
5	Measurement of OD and concentration of unknown solution using colorimeter
6	Study of working of clinical bio-chemistry analyzer
7	Study of blood cell counter
8	Study of bed side patient monitor
9	X-ray imaging
10	Verification of bio-telemetry

References:

Sl No.	**Title of Book**	**Author**	**Publication**
1.	Handbook of Biomedical Instrumentation	R.S. Khandpur	Tata McGraw Hill
2.	Handbook of Biomedical Instrumentation	H.E. Thomas	Prentice Hall of India
3.	Biomedical instrumentation and Measurement	L. Cromwell, F.J. Weibell & E.A. Peiffer	Prentice Hall of India
4.	Electronics for Biomedical Personnel	E.J.B.	BucksteinTaraporewala
5.	Biomedical Instrumentation	Can & Brown	

6.	X-ray techniques for students	M.O. Chasney	
7.	Recent Advances in Biomedical Engineering	Reddy	

Name of the course: **Project**	
Course Code: ETCE/PRO/S5	Semester: Fifth
Duration: 15 Weeks	Maximum Marks: 100 Marks
Practical:4contact hours/week	
Credit: 2	

Course Outcomes:

On completion of the course students will be able to :

- Work in Groups, Plan the work, and Coordinate the work.
- Develop leadership qualities.
- Analyse the different types of Case studies.
- Develop Innovative ideas.
- Develop basic technical Skills by hands on experience.
- Write project report.
- Develop skills to use latest technology in Electronics field.

Contents:

During fifth semester students will collect information, analyze the information and select the project. They will also prepare the List of the components required, PCB design, Testing Procedure, Design of the Cabinet or Box or Board as the case may be. They will also prepare a synopsis of the project.

So at sixth semester they have to execute the project. A tentative Schedule is proposed below:

Proposed Schedule:

Design and testing of various electronics circuits through simulation tools like- Matlab, Multisim, Proteus etc. **(04 Weeks)**

Procuring components, component testing and circuit testing. **(02 Weeks)**

PCB making and onboard testing- i) PCB designing of electronics projects by using orcad, proteus, circuit maker etc. simulation tools. ii) Printing, etching and drilling of circuit board. iii) Soldering and disordering of components as per design. iv) PCB and hardware testing. **(06 Weeks)**

Mounting the PCB inside cabinet. **(01 Week)**

Documentation. **(02 Weeks)**

Project Work is intended to provide opportunity for students to develop understanding of the interrelationship between different courses learnt in the entire diploma programme and to apply the knowledge gained in a way that enables them to develop & demonstrate higher order skills. The basic objective of a project class would be to ignite the potential of students' creative ability by enabling them to develop something which has social relevance, aging, it should provide a taste of real life problem that a diploma-holder may encounter as a professional. It will be appreciated if the polytechnics develop interaction with local industry and local developmental agencies viz. different Panchayet bodies, the municipalities etc. for choosing topics of projects and / or for case study. The course further includes preparation of a Project Report which, among other things, consists of technical description of the project. The Report should be submitted in two copies, one to be retained in the library of the institute. The Report needs to be prepared in computer using modern software wherever necessary.

General Guideline:

Project Work is conceived as a group work through which the spirit of team building is expected to be developed. Students will be required to carry out their Project Works in groups under supervision of a lecturer of their core discipline who will work as a Project Guide. It is expected that most of the lecturers of the core discipline will act as project guide and each should supervise the work of at least two groups. Number of students per group will vary with

the number of lecturers acting as Project Guide and student strength of that particular class.

The Project:

The students should be made aware of the factors influencing the selection of a particular product and its available design, viz. selection of components for assembling, harnessing, testing and quality control of the same. They should also be aware of the workability of the product. Each group will take at least one project in a semester.

Project Report:

Each project work should be accompanied by a 'Project Report' which should cover the following:—
(a) Literature survey;
(b) General description;
(c) Product specification;
(d) Hardware description;
(e) Operating instruction;
(f) Installation requirement, if any;
(g) Circuit diagrams;
(h) Layout diagrams;
(i) List of components;
(j) Costing;
(k) Study of marketability;
(l) Scope for future development;
(m) A brief outline of the maintenance procedure may also be included in the report (if possible).

Suggested List of Project Works:

The project works are generally selected depending upon the objective of the course and the infrastructural facilities available at a particular institution. Some of the popular items are listed below as guideline for selection:— (i) regulated power supply; (ii) AC voltage stabilizer; (iii) inverter; (iv) battery charger; (v) FM receiver; (vi) bar level indicator; (vii) digital thermometer; (viii) field strength meter; (ix) digital clock; (x) solid state relay; (xi) stereo amplifier; (xii) Solar appliances like solar lantern, solar inverter, solar mobile/battery charger etc. (xiii) programmable interval time; (xiv) analog trainer kit; (xv) digital trainer kit; (xvi) circuit theory trainer kit; (xvii) microprocessor trainer kit; (xviii) telephone line / status monitor; (xix) MICROCONTROLLER BASED APPLICATIONS: (a) temperature controller, (b) alarm, (c) moving display, (d) speed control of motor, (e) programmable logic controller etc.; (xx) one project on computer application ; (xxi) one project on any one of the elective subjects; (xxii) real time embedded systems; (xxiii) Project on Internet of Things (xxiv) Any other suitable project referred from relevant books/ journals or emerging areas of electronics and communication technology after thorough review of the literature from internet.

References:

1. Any Journal Related to Electronics/Computer/Information Technology
2. https://www.pinterest.com
3. https://www.electronicsforu.com
4. https://www.electronicshub.org
5. https://www.elprocus.com

Name of the course: **Internship-II**	
Course Code: ETCE/INT-II/S5	Semester: Fifth
Duration: During vacation(3-4 weeks)	Maximum Marks: 100 Marks
Credit: 1	

Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry. In case students want to pursue their family business and don't want to undergo internship in any industry, a declaration by a parent may be submitted directly to the TPO and he/she has to submit a detailed project report on entrepreneurial activities.

OR Students may choose Rural/ Social Internship Programme: Various initiatives in a rural belt for technological intervention and networking for holistic transformation of the rural population by identifying the possibilities of localized employment, convergence, cost reduction, Youth and Women empowerment etc and he/she has to submit a detailed report to faculty mentor/TPO/NSS head for evaluation.

Course Outcomes:

On completion of the course students will be able to :

- Understand the real time industrial environment.
- Get exposure about entrepreneurship development.
- Learn about the training and simulation program of the industry.
- Handle different Industrial equipments/machineries with latest technology.
- Create conditions conducive to quest for knowledge and its applicability on the job.
- Expose the students to future employers.
- Creating network and social circle and developing relationships through upliftment of the society.

West Bengal State Council of Technical & Vocational Education and Skill Development
(Technical Education Division)

Syllabus
of

Diploma in Electronics & Communication Engineering [ECE] & Electronics & Tele-Communication Engineering [ETCE]

Part-III (6th Semester)

Revised 2022

Further suggestion may be submitted to the syllabus committee. List of the coordinators for the branch of Diploma in Electronics & Tele Communication Engineering are:

Sl No.	Name	Designation	Mobile No.	Email id
1.	**Sri Ashim Kumar Manna**	**OSD to the DTE&T (On Deputation) (Lecturer in ETCE)**	**8902701784**	ashimmanna1962@gmail.com
2.	**Dr. Marina Dan**	**Lecturer in ETCE**	**9831115387**	marina@wbscte.ac.in
3.	**Dr. Anup Sarkar**	**Lecturer in ETCE**	**9433521132**	anup@wbscte.ac.in
3.	**Sri Rabindra Nath Kundu**	**Lecturer in ETCE**	**9064483649**	rabink@wbscte.ac.in
5.	**Sri Sanku Prasad Mitra**	**Lecturer in ETCE**	**9830548556**	sanku@wbscte.ac.in
6.	**Sri Sumit Kumar Das**	**Lecturer in ETCE**	**9830551752**	sumit.rick@wbscte.ac.in
7.	**Ms. Kakali Mudi**	**Lecturer in ETCE**	**9051931699**	kakali.electronics@wbscte.ac.in

WEST BENGAL STATE COUNCIL OF TECHNICAL EDUCATION											
TEACHING AND EXAMINATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES											
COURSE NAME:FULL TIME DIPLOMA IN ETCE & ECE											
DURATION OF COURSE: 6 SEMESTERS											
SEMESTER: SIXTH											
BRANCH: ELECTRONICS & TELECOMMUNICATION ENGG. AND ELECTRONICS & COMMUNICATION ENGG.											
SR. NO.	SUBJECT	CREDITS	PERIODS		EVALUATION SCHEME						
			L	PR	THEORETICAL				PRACTICAL		Total Marks
					TA	CT	Total	ESE	Internal	External	
1.	Open Elective-I: Engineering Economics and Project Management	3	3	-	20	20	40	60	-	-	100
2.	Entrepreneurship and Startups	3	3	-	20	20	40	60	-	-	100
3.	Industrial Automation or Control System and PLC	3	3	-	20	20	40	60	-	-	100
4.	Computer Networking and Data Communication	3	3	-	20	20	40	60	-	-	100
5.	Open Elective-II (Select any one): i) Industrial Management ii) Environmental Engineering & Science i) Renewable Energy Technologies	3	3	-	20	20	40	60	-	-	100
6.	Computer Networking and Data Communication Lab	1	-	2	-	-	-	-	60	40	100
7.	Industrial Automation Lab or Control System and PLC Lab	1	-	2	-	-	-	-	60	40	100
8.	Project	2	-	4	-	-	-	-	60	40	100
9.	Seminar	2	-	2	-	-	-	-	60	40	100
	Total	21	15	10	100	100	200	300	240	160	900

- **STUDENT CONTACT HOURS PER WEEK: 25 hours**
- **ACADEMIC CONTACT WEEKS PER SEMESTER:17 weeks(Teaching-15 weeks +Internal Exam-2 weeks)**
- **THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH**
- **ABBREVIATIONS:L- Lecture, PR-Practical, IA- Internal Assessment, CT- Class Test, ESE-End Semester Exam**
- **IA (Internal Assessment for Theoretical)=40 marks: CT=20 Marks, Attendance=10 marks and Quizzes/Assignment/Student Activity=10 marks.**
- **Minimum qualifying marks for both Theoretical and Sessional subjects (for internal assessment and external assessment separately) are 40%.**
- **IA (Internal Assessment for Practical)=60 marks:50 marks for continuous evaluation and 10 marks for Class attendance.**
- **Seminar topics should be relevant to the corresponding disciplines.**

Name of the course: Industrial Automation	
Course Code: ETCE/DIA/S6	Semester: Sixth
Duration: One Semester (Teaching– 15 weeks + Internal Exam-2weeks)	Maximum Marks:100 Marks
Teaching Scheme:	**Examination Scheme:**
Theory: 3contact hrs./week	Class Test(Internal Examination):20 Marks
Practical:2contact hours/week	Attendance=10 marks and Quizzes/Assignment/Student Activity= 10 marks
	End Semester Examination:60 Marks
Credit:4(TH:3+PR:1)	Practical:100 Marks

Course Outcomes:

After completion of the course students will able to

- Understand the role of control elements in a close (single) loop and open loop control for Industrial Process Automation.
- Identify proper control devices for defined process automation.
- Use ON-OFF and PID controller for a defined process during automation.
- Interface field devices (sensors/actuators) with PLC/SCADA/DCS.
- Develop control loop in PLC by using Ladder logic/block logic program.

Content(Name of the topic)		Periods
Group–A		
Unit 1	**Introduction to Industrial Automation**	**04**
	1.1 Introduction to Industrial process and automation. 1.2 Need of Automation - Quality, Safety, Sustainability and Economic aspect. 1.3 Process Control: Process definition, Process gain, Open Loop Control, Close loop Control. 1.4 Example of open loop control. 1.5 Example of close loop control - Temperature control loop, Level control loop (With their functional explanation).	
Unit 2	**Sensor and Actuators**	**14**
	2.1 Define automation components: Sensor, Transmitter, Controller, Actuator, A/D & D/A conversion, Signal conditioning (Conceptual schematic). 2.2 Working principle and types of i) pressure transmitter, ii) temperature transmitter, iii) level transmitter and iv) flow transmitter v) proximity transmitter. 2.3 Elements and standards of Signal Conditioning and transmitting. 2.4 Actuators: Type and examples of Hydraulic, Pneumatic and Electric actuators. Control Valve –Working principle and functional diagram of Pneumatic, Electric type and Solenoid valve. Motor Drives – Types (VFD, Soft starter) and Functional diagram only. 2.5 Calibration principle- Zero and Span setting with standards, Calibration Chain- Primary reference (National and International Standards), Secondary Reference (Standard Lab) and Working Standard (Only definition).	
Group–B		
Unit 3	**Control Engineering**	**05**

	3.1 Standard Test Signals: Unit Step, Unit ramp, Impulse function and their Laplace transform. 3.2 Transfer function definition – Poles and Zeros, 1st order system and 2nd order system. Example of 1st order and 2nd order system. Characteristics equations. Concept of stability using characteristics equation. 3.3 Time domain analysis of 1st order system by step input signal- Transient response and steady state response with example.	
Unit 4	**Control Actions and Process Controllers**	**10**
	4.1 Process control system – block diagram, elements. Role of Controllers in Process Industry. 4.2 Control actions - discontinuous & continuous modes; On - Off controllers: Neutral zone, Hysteresis Zone. 4.3 Proportional controllers (offset, proportional band); Integral &Derivative controllers - Functional block diagram and Equation. 4.4 Composite controllers -Functional block diagram and Equation of PI, PD, PID controllers. 4.5 Parameters of P, PI, and PID controllers and tuning concept.	
	Group–C	
Unit 5	**Automation and Control System**	**12**
	5.1 Communication Hierarchy in Process Automation- Field level, I/O level, Control level, HMI level, Enterprise level. 5.2 Piping and Instrumentation Diagram: Concept, symbols, reading procedure. 5.3 PLC- Functional Diagram, working principle, Analog I/O module, Digital I/O module- Source and Sink. 5.4 PLC programming basics– Ladder logic, Block logic (identify the problem for three input variables and two output variables both analog and digital). 5.5 DCS- Definition, functional diagram and distributed network and interfacing concept. Comparison between PLC & DCS and applicability. 5.6 SCADA- Introduction, Concept of Supervisory Control, Human-Machine Interface and Alarm handling. 5.7 Industrial Networking: Basic features ofFieldbus, Foundation Fieldbus,Profibus, HART, Ethernet, Modbus, Profinet.	
	Total	**45**

Sl.No.	Suggested List of Laboratory Experiments
1	Water level control using On-Off method.
2	Temperature control using PID controller.
3	Develop ladder/block program using three digital inputs and two digital outputs (combinational logic).
4	Test ladder program for pulse counting by using limit switch/proximity sensor.
5	Temperature control using RTD/Thermocouple, PLC (PID block), heating element.
6	PID control using Electro Pneumatic control valve/cylinder, I/P converter.
7	Use various functions of SCADA simulation editors to develop simple project.
8	Do any other experiment except above using PLC as per availability of sensor and actuators.
9	**Do at least one Mini-Project for automation using sensor, controller and actuators.**

References:

Sl No.	Title of Book	Author	Publication
1.	Process Control Instrumentation Technology	Johnson	Pearson
2.	Process Control	Bela G. Liptak	Elsevier Science (3rd Edition)
3.	Process Control Modeling, Design and Simulation	B. W. Bequette	PHI
4.	ElectronicMeasurementandMeasurementTechnique	Cooper	PrenticeHallofIndia
5.	Modern Electronic Instrumentation & Measurement Techniques	Helfrick & Cooper	Pearson
6.	Modern Control Engineering	Ogata	Pearson
7.	Control System Engg	J.J.Nagrath & M. Gopal	Wiley
8.	Modern Control System	Rameshbabu and R. Anandrajan	SCITECH
9.	Control System	Kumar	Tata McGraw-Hill
10.	Basic Instrumentation System & Programmable Logic Controller	Umesh Rathore	Katson Books
11.	Programable Logic Controller	Jadhav V. R.	Khanna Publisher, New Delhi
12.	SCADA	Boyar B. A.	ISA Publication New Delhi,
13.	Practical SCADA for Industry	Bailey, David; Wright, Edwin	Newnes (an imprint of ElsevierI International edition, 2003, ISBN: 0750658053

Name of the course: Control System and PLC	
Course Code: ETCE/DCSP/S6	Semester: Sixth
Duration: One Semester (Teaching– 15 weeks + Internal Exam-2weeks)	Maximum Marks:100 Marks
Teaching Scheme:	**Examination Scheme:**
Theory: 3contact hrs./week	Class Test(Internal Examination):20 Marks
Practical: 2contact hours/week	Attendance=10 marks and Quizzes/Assignment/Student Activity= 10 marks
	End Semester Examination:60 Marks
Credit:4(TH:3+PR:1)	Practical:100 Marks

Course Outcomes:

After completion of the course students will able to

- Identify different components and types of control systems and their representations.
- Analyze the response of a control system for standard inputs and comment on its stability.
- Evaluate the performance of various types of controllers.
- Identify various components of PLC and its hardware.
- Apply PLC in various control systems by its proper programming.

Content(Name of the topic)		Periods
	Group–A	
Unit 1	**Basics of Control System**	**08**
	1.1 Control Systems: Definition of Control System, Classification of Control Systems with block diagram- open loop and closed loop control system with examples, Comparison between open loop and close loop control system. 1.2 Mathematical Models of Physical systems: Concept of Transfer Function and deduction of transfer function of close loop control system, Block diagram reduction technique using Laplace Transform, Signal Flow Graphs and Messon's Gain formula for block diagram reduction technique with simple problems.	
Unit 2	**Time Domain Stability Analysis**	**16**
	2.1 Time Response: Transient and Steady State Response 2.2 Standard Test Inputs: Unit Step, Unit Ramp, Unit Parabolic, Unit Impulse functions and their corresponding Laplace Transform. 2.3 Analysis of First and Second Order Control System: i) First Order System: Analysis for Unit Step Input, Concept of Time Constant, Steady State Error. ii) Second Order System: Analysis for Unit Step Input, Definition and Effect of Damping. iii) Time Response Specifications: Delay time, Rise time, Peak Time, Peak Overshoot, Settling time, Simple Numerical Problems. iv) Initial value and final value theorems and their use in control systems. v) Types of feedback control systems and error constants. 2.4 Stability: Concept of Poles and Zeroes , Concept of Stability, Root Locations in s-plane and Analysis – Stable System, Unstable System, Critically Stable Systems, Conditionally Stable System. 2.5 Routh's Stability Criteria: Steps and Procedures to find Stability by using Routh's Stability Criteria with simple problems.	
	Group–B	
Unit 3	**Process Controllers**	**06**
	3.1 Process Control System: Block Diagram with example, Functions of Each Block 3.2 Control Actions: i) Discontinuous Mode: ON-OFF Controllers, Neutral Zone. ii) Continuous Modes: a) Proportional Controller – Offset, Proportional Band b) Proportional, Integral and Derivative Controllers – Output Equation, Response, Characteristics c) Composite Controllers: PI, PD, PID Controllers – Output Equation, Response Characteristics	
Unit 4	**Fundamentals of PLC and its Hardware**	**07**
	4.1 Introduction – Advantages of PLC Based Control over Conventional Relay Based Control, Classification of PLC (Fixed and Modular PLCs) 4.2 Architectural Details of PLC: Block Diagram of PLC, CPU and Program Scan, Input Modules (Discrete and Analog), Output Modules (Discrete and Analog), Memory (its organization and addressing), Power Supply and Programming Devices - Function of each block. 4.3 PLC Installation.	
	Group–C	
Unit 5	**Basics of PLC Programming**	**08**

	5.1 PLC Instruction Set: Relay Instructions, Logical Instructions, Program Control instructions, Timer and Counter Instructions, Data Handling Instructions. 5.2 Ladder Logic Diagram: Elements of Ladder Diagram, Evaluation of Rung, Program examples and Problems.	
	Total	**45**

Sl.No.	Suggested List of Laboratory Experiments
1	To study the step response of R-C Circuit (First Order System).
2	To study the step response of R-L-C Circuit (Second Order System).
3	To study the operation of an ON-OFF controller.
4	To study the operation of a Proportional controller.
5	To study the operation of a PI controller.
6	To study the operation of a PD controller.
7	To study the operation of a PID controller.
8	To study MATLAB simulation for different types of Control System.
9	To Identify and test different parts of a PLC.
10	To develop Ladder Diagram to test the functionality of different logic gates.
11	To develop Ladder Diagram for Adder and Subtractor by using PLC
12	To develop Ladder Diagram for ON-OFF control of a lamp using Timer and Counter.
13	To develop Ladder Diagram for Traffic Light Control System
14	To develop Ladder Diagram for Stepper Motor Control

References:

Sl No.	Title of Book	Author	Publication
1.	Control System Engg	J.J.Nagrath & M. Gopal	Wiley
2.	Modern Control Engineering	K. Ogata	Pearson
3.	Modern Control System	Rameshbabu and R Anandrajan	SCITECH
4.	Automatic Control Systems	K Sridhar	Wiley India
5.	Automatic Control System	B.C. Kuo	PHI
6.	Control System	Kumar	Tata McGraw-Hill
7.	Modern Control Theory	Brogan	Pearson
8.	Programmable Logic Control- Principles and Applications	NIIT	PHI
9.	Basic Instrumentation System & Programmable Logic Controller	Umesh Rathore	Katson Books
10.	Programmable Logic Controller	Frank Petruzella	McGraw Hill
11.	Programmable Logic Controller	W Bolton	Newnes

Name of the course: Computer Networking and Data Communication	
Course Code: ETCE/DCNDC/S6	Semester: Sixth
Duration: One Semester (Teaching– 15 weeks + Internal Exam-2weeks)	Maximum Marks:100 Marks
Teaching Scheme:	**Examination Scheme:**
Theory: 3contact hrs./week	Class Test(Internal Examination):20 Marks
Practical: 2contact hours/week	Attendance=10 marks and Quizzes/Assignment/Student Activity= 10 marks
	End Semester Examination:60 Marks
Credit:4(TH:3+PR:1)	Practical:100 Marks
Course Outcomes:	

After completion of the course students will able to

- Explain basic concepts of LAN, MAN, WAN, different Network Topologies and concept of different types of switching.
- Analyze the services and role of each layer of OSI model
- Analyze, specify and design the topological and routing strategies for an IP based networking infrastructure
- Explain the different protocols used at application layer i.e. HTTP, SMTP, SNMP, FTP, TELNET and VPN.
- Analyze performance of various communication protocols.
- Explain basic knowledge of the use of cryptography and network security.

Content(Name of the topic)		Periods
Group–A		
Unit 1	**NETWORK BASICS: STRUCTURE & REFERENCE MODEL**	**10**
	1.1 **Idea of computer network** – Network components 1.2 **Types of Network** – Classify networks by their Geography- LAN, MAN & WAN; Classify Networks by their Network role: Peer to Peer, Client- Server Model. 1.3 **Network topology**- Bus Topology, Ring Topology, Star Topology, Mesh Topology, Tree Topology, Hybrid Topology. 1.4 **SWITCHING**: Circuit Switching – Message Switching – Packet Switching. 1.5 **Layered architecture of network system** – Seven-layer OSI model – Functions of each OSI layer – Other ISO structure – TCP / IP Layer Structure, Comparison between OSI and TCP/IP models.	
Unit 2	**TRANSMISSION MEDIA AND NETWORKING DEVICES**	**10**
	2.1 **Classification of Transmissions Medium:** Compare between Unguided and Guided medium. Twisted Pair Cable (UTP, STP), Coaxial Cable, Optical Fiber Cable and Wireless Transmission Media (IR, Microwave). 2.2 **Network Hardware Components** – NIC, Hubs, Switches - Layer 2 and Layer 3 Switches, Routers, Bridges, Repeaters, Gateways, Modems. 2.3 **Routing Algorithms**: Concept of Static Routing, Dynamic Routing, Distance Vector Routing Algorithm and Routing Information Protocol.	
Group–B		
Unit 3	**IP Protocol and Network Applications**	**12**

	3.1 **IP addressing:** IP v4 Classful and Classless addressing, Subnetting and Super netting, Subnet Mask and Default Mask, Class less Inter Domain Routing (CIDR). 3.2 **IPV6:** Types and advantages, Difference between IPV4 with IP V6. 3.3 TCP/IP Protocols, Configuring TCP/IP. 3.4 **Other Network Layer Protocols:** ARP, RARP, ICMP, UDP, Difference between TCP and UDP.	
Unit 4	**Application Layer Services**	**07**
	4.1 Structure and Objectives of Intranet & Internet, Use of Firewall and proxy server. 4.2 Working of Email – POP-3, SMTP, MIME; TELNET, FTP, SNMP, World Wide Web, URL, HTTP, Working of DNS and DHCP Server. 4.3 Working of VoIP, VPN and VSAT.	
	Group–C	
Unit 5	**NETWORK and CYBER SECURITY**	**06**
	5.1 **Different aspects of SECURITY**: Privacy – Authentication – Integrity – Non-Repudiation. 5.2 **ENCRYPTION / DECRYPTION**: Data Encryption System – Secret key method – Public key method (RSA algorithm), Digital signature. 5.3 Define Cyber Security, Types of Cyber Security Threats -Phishing, Ransom ware, Malware, Social Engineering, Emotet, Man in the Middle (MITM), Password Attack, Spyware, Hacking, Viruses, Trojan and Worm.	
	Total	**45**

Sl. No.	Suggested List of Laboratory Experiments
1	Compare and configure different Network Topologies physically or by using CISCO Packet Tracer software.
2	Compare and demonstrate Network directing devices: Repeater, Hub, Switch, Bridge, Router, Gateway.
3	Study of different types of Network cables and practically implement the cross wired cable and straight through cable by using crimping tool and RJ-45 Connector.
4	Connect the Computers in Local Area Network.
5	Study of different types of IP Addressing and Subnetting and Super netting concepts.
6	Configuring TCP/IP Network.
7	Study of basic Network and Network configuration commands.
8	Web page designing by using HTML.

References:

Sl No.	Title of Book	Author	Publication
1.	Computer Networks, 4th edition	A. S. Tanenbaum (2003)	Pearson Education/ PHI, New Delhi, India
2.	Data communication and Networking, 4th Edition	Behrouz A. Forouzan (2006)	Mc Graw-Hill, India
3.	Computer Networking: A top down approach	Kurose, Ross (2010)	Pearson Education, India
4.	Computer Networks	Bhushan Trivedi	Oxford University Press, 2013
5.	Computer Networks and Internets	Comer	Pearson
6.	Computer Networking with Internet Protocols	Stallings	Pearson

7.	A COURSE IN COMPUTER NETWORKS	Dr. Sanjay Sharma	S K Kataria & Sons

Name of the course: **Project**	
Course Code: ETCE/PRO/S6	Semester: Sixth
Duration: 15 Weeks	Maximum Marks: 100 Marks
Practical:4contact hours/week	
Credit: 2	

Course Outcomes:

On completion of the course students will be able to :

- Work in Groups, Plan the work, and Coordinate the work.
- Develop leadership qualities.
- Analyse the different types of Case studies.
- Develop Innovative ideas.
- Develop basic technical Skills by hands on experience.
- Write project report.
- Develop skills to use latest technology in Electronics field.

Contents:

At sixth semester they have to execute the project. A tentative Schedule is proposed below:

Proposed Schedule:

Design and testing of various electronics circuits through simulation tools like- Matlab, Multisim, Proteus etc. **(04 Weeks)**

Procuring components, component testing and circuit testing. **(02 Weeks)**

PCB making and onboard testing- i) PCB designing of electronics projects by using orcad, proteus, circuit maker etc. simulation tools. ii) Printing, etching and drilling of circuit board. iii) Soldering and disordering of components as per design. iv) PCB and hardware testing. **(06 Weeks)**

Mounting the PCB inside cabinet. **(01 Week)**

Documentation. **(02 Weeks)**

Project Work is intended to provide opportunity for students to develop understanding of the interrelationship between different courses learnt in the entire diploma programme and to apply the knowledge gained in a way that enables them to develop & demonstrate higher order skills. The basic objective of a project class would be to ignite the potential of students' creative ability by enabling them to develop something which has social relevance, aging, it should provide a taste of real life problem that a diploma-holder may encounter as a professional. It will be appreciated if the polytechnics develop interaction with local industry and local developmental agencies viz. different Panchayet bodies, the municipalities etc. for choosing topics of projects and / or for case study. The course further includes preparation of a Project Report which, among other things, consists of technical description of the project. The Report should be submitted in two copies, one to be retained in the library of the institute. The Report needs to be prepared in computer using modern software wherever necessary.

General Guideline:

Project Work is conceived as a group work through which the spirit of team building is expected to be developed. Students will be required to carry out their Project Works in groups under supervision of a lecturer of their core discipline who will work as a Project Guide. It is expected that most of the lecturers of the core discipline will act as project guide and each should supervise the work of at least two groups. Number of students per group will vary with the number of lecturers acting as Project Guide and student strength of that particular class.

The Project:

The students should be made aware of the factors influencing the selection of a particular product and its available design, viz. selection of components for assembling, harnessing, testing and quality control of the same. They should also be aware of the workability of the product. Each group will take at least one project in a semester.

Project Report:

Each project work should be accompanied by a 'Project Report' which should cover the following:—
(a) Literature survey;
(b) General description;
(c) Product specification;
(d) Hardware description;
(e) Operating instruction;
(f) Installation requirement, if any;
(g) Circuit diagrams;
(h) Layout diagrams;
(i) List of components;
(j) Costing;
(k) Study of marketability;
(l) Scope for future development;
(m) A brief outline of the maintenance procedure may also be included in the report (if possible).

Suggested List of Project Works:

The project works are generally selected depending upon the objective of the course and the infrastructural facilities available at a particular institution. Some of the popular items are listed below as guideline for selection:— (i) regulated power supply; (ii) AC voltage stabilizer; (iii) inverter; (iv) battery charger; (v) FM receiver; (vi) bar level indicator; (vii) digital thermometer; (viii) field strength meter; (ix) digital clock; (x) solid state relay; (xi) stereo amplifier; (xii) Solar appliances like solar lantern, solar inverter, solar mobile/battery charger etc. (xiii) programmable interval time; (xiv) analog trainer kit; (xv) digital trainer kit; (xvi) circuit theory trainer kit; (xvii) microprocessor trainer kit; (xviii) telephone line / status monitor; (xix) MICROCONTROLLER BASED APPLICATIONS: (a) temperature controller, (b) alarm, (c) moving display, (d) speed control of motor, (e) programmable logic controller etc.; (xx) one project on computer application ; (xxi) one project on any one of the elective subjects; (xxii) real time embedded systems; (xxiii) Project on Internet of Things (xxiv) Any other suitable project referred from relevant books/ journals or emerging areas of electronics and communication technology after thorough review of the literature from internet.

References:

1. Any Journal Related to Electronics/Computer/Information Technology
2. https://www.pinterest.com
3. https://www.electronicsforu.com
4. https://www.electronicshub.org
5. https://www.elprocus.com

Name of the course: **Seminar**	
Course Code: ETCE/SEMINAR/S6	Semester: Sixth
Duration: 15 Weeks	Maximum Marks: 100 Marks
2contact hours/week	
Credit: 2	
Seminar topic should be related to the project work or any other relevant topics. Each student shall submit a report of 5 to10 pages and deliver a seminar (Presentation time – 10 minutes) on that topic.	