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)

2023

2

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

2

	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						Total Marks
			L	PR	THEORETICAL				PRACTICAL		
					TA	CT	Total	ESE	Internal	External	
1.	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 (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	-	1	-	-	-	-	60	40	100
	Total	**21**	**15**	**9**	**100**	**100**	**200**	**300**	**240**	**160**	**900**

- **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.**
- **Seminar topics should be relevant to the corresponding disciplines.**

<table>
<tr><td colspan="2" align="center">Name of the course: Industrial Automation</td></tr>
</table>

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:	

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