

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:

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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 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 of Fieldbus, 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 (3 rd Edition)
3.	Process Control Modeling, Design and Simulation	B. W. Bequette	PHI
4.	Electronic Measurement and Measurement Technique	Cooper	Prentice Hall of India
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 Elsevier) 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
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Name of the course: Project	
Course Code: ETCE/PRO/S6	Semester: Sixth
Duration: 15 Weeks	Maximum Marks: 100 Marks
Practical: 4 contact 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 disassembling 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 timer; (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.	