BANGLADESH TECHNICAL EDUCATION BOARD

Agargaon, Sher-E-Bangla Nagar

Dhaka-1207.

04-YEAR DIPLOMA IN ENGINEERING CURRICULUM

COURSE STRUCTURE & SYLLABUS

(PROBIDHAN-2022)

ELECTRICALTECHNOLOGY

TECHNOLOGY CODE: 67

5TH SEMESTER

(Effective from 2022-2023 Academic Sessions)

DIPLOMA IN ENGINEERING CURRICULUM

COURSE STRUCTURE

(PROBIDHAN-2022)

TECHNOLOGY NAME: ELECTRICAL TECHNOLOGY (67)

(5th SEMESTER)

Sl. No.	Subject		Period Per Week		Credit	Marks Distribution						Grand Total
						Theory Assessment			Practical Assessment			
	Code	Name	Theory	Practical		Continuous	Final	Total	Continuous	Final	Total	
1	25851	Principle of Marketing	2	-	2	40	60	100	-	-	-	100
2	25852	Industrial Management	2	-	2	40	60	100	-	-	-	100
3	26751	Generation of Electrical Power	3	3	4	60	90	150	25	25	50	200
4	26752	Electrical & Electronic Measurements-I	2	3	3	40	60	100	25	25	50	150
5	26753	Testing and Maintenance of Electrical Equipment's	2	3	3	40	60	100	25	25	50	150
6	26754	Electrical Engineering Project-II	-	6	2	-	-	-	50	50	100	100
7	26853	Microprocessor & Microcontroller	3	3	4	60	90	150	25	25	50	200
		Total	**14**	**18**	**20**	**280**	**420**	**700**	**150**	**150**	**300**	**1000**

Subject Code	Subject Name	Period per Week		Credit
25851	**Principles of Marketing**	T	P	C
		2	0	2

Rationale	This subject scrutinizes the business function of Marketing. Textile students need to learn identifying the proper target market and decide upon appropriate products, services, and programs to serve these markets. Moreover, students need to know how marketers deliver value in satisfying customer needs and wants. This subject will cover areas include fundaments of marketing, branding, consumer behavior, marketing mixes, promotion, marketing channel, international marketing, online marketing and implementation of ethics will benefit the students to gain an elementary scenario of marketing knowledge.
Learning Outcome (Theoretical)	After undergoing the subject, students will be able to: 1. Describe marketing and marketing function. 2. Distinguish between sales and marketing 3. Interpret significance of marketing in own filed. 4. Explore opportunities of international marketing 5. Analyze marketing theories and marketing mix elements for product promotion. 6. Solve the complexity arises from market environment. 7. State classification of products marketing 8. State distribution channels 9. Explain implementation procedure of market segmentation, targeting and positioning strategies in product marketing. 10. Interpret pricing tactics to get competitive advantages. 11. Analyze branding and branding elements 12. Explain ethical marketing and its significance

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1	**INTRODUCTION TO MARKETING** 1.1 Define marketing 1.2 Explain functions of marketing 1.3 Differentiate between sales and marketing 1.4 Describe marketing prospects on the context of 4th industrial revolution 1.5 Discuss marketing importance on apparel industry.	4	**6**
2	**MARKETING THEORIES AND STRATEGIES** 2.1. Explain core concept of marketing 2.2. Describe basic strategies and SWOT analysis of marketing 2.3. Define marketing mixes 2.4. Mention 7Ps of marketing 2.5. Compare between 4Cs and 4Ps of marketing	4	**7**
3	**MARKET ENVIORNMENT AND INTERNATIONAL MARKTING** 3.1 Describe market environment 3.2 Discuss micro environment and macro environment. 3.3 List the influential factors of market environment related with own industrial field 3.4 Define international marketing 3.5 Describe international market entry process 3.6 Classify international marketing	3	**7**
4	**PRODUCT AND SERVICE MARKETING** 4.1. Define product 4.2. Discuss good and service 4.2. Explain product life cycle 4.3. Classify product levels 4.5 Classify service marketing 4.6 Distinguish between goods and service	3	**7**
5	**DISTRIBUTION STRATEGIES** 5.1. Define distribution 5.2. State the necessity of distribution in marketing 5.3. Illustrate types of distribution channel	2	**4**
6	**SEGMENTATION, TARGETING AND POSITIONING METHODS** 6.1. Discuss market segmentation 6.2 Explain bases for consumer market segmentation	4	**7**

	6.3 Define market targeting 6.4 Describe strategies of targeting 6.5 Define positioning, repositioning and de-positioning			
7	**ESSENTIALS OF PROMOTION AND PRICING** 7.1 Define promotion 7.2 State fundaments of promotion 7.3 Relate managing customer relationships 7.4 Define price 7.5 Outline new product pricing strategies 7.6 Compare price adjustments with competitors	4	**7**
8	**FUNDAMENTALS OF BRANDING** 8.1 Define branding 8.2 List branding elements 8.3 State necessity of branding 8.4 Mention the steps of brand making process	2	**4**
9	**CONSUMER BEHAVIOUR** 9.1 Define consumer behavior 9.2 Outline stages of the buying process 9.3 Illustrate importance of studying consumer behavior 9.4 Mention the scope of consumer behavior area	2	**4**
10	**ONLINE AND ETHICAL MARKETING** 10.1 Define marketing ethics 10.2 Mention policies of marketing ethics 10.3 State the practice of ethics on virtual market. 10.4 Describe significance of the ethical practices on social media 10.4 Discuss Corporate Social Responsibility (CSR) 10.5 Discuss the consequence of green marketing	4	**7**
	Total	**32**	**60**

Recommended Books:

SL	Book Name	Writer Name	Publisher Name & Edition
1.	Principles of Marketing	Gray Armstrong/ Philip Kotler	Prentice Hall, NJ,USA 17th Edition

| 2. | Marketing Management | Rajan Saxsena | Tata McGraw-Hill Education, 1st Edition, 2005 |

Subject Code	Subject Name	Period per Week		Credit
		T	P	C
25852	**INDUSTRIAL MANAGEMENT**	**2**	**0**	**2**

Rationale	As mid-level manager, engineering diploma graduates are responsible for proper and most efficient interaction of 6 M`S: man, machine, material, money, method (SOP or process) and market with a focus that will depend on their position in the organization (production, planning, quality, maintenance, design, etc.). They first need to understand the type of management and organization they work in. As they work directly or indirectly with manufacturing, therefore they need to have knowledge, skills and attitudes on production, planning, productivity improvement, new systems such as lean manufacturing and understand how production integrates in the overall supply chain management. They deal with people either as a supervisor, assistant manager or by leading transversal projects, they should know their role concerning human resources management and development. In their daily work, they must use a suitable leadership style, assign and monitor work, solve problems, support motivation to change of their teams when they implement new methods and systems.
Learning Outcome (Theoretical)	**After undergoing the subject, students will be able to:** ☐ State the roles and responsibilities of a mid-level manager within the organization ☐ Differentiate various management systems and organizations ☐ Describe the manufacturing process ensuring productivity, quality, cost and safety ☐ State the types of production planning ☐ Explain productivity improvement factors while controlling cost ☐ Describe new trends of production management systems ☐ Identify mid-level manager roles in the human resources management and development ☐ Select the suitable leadership style depending on the situations and people ☐ Identify the steps of work assignment based on goals to achieve while supporting changes ☐ Describe the steps of problem solving and decision making

DETAIL DESCRIPTION (THEORY:

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	**FUNDAMENTALS OF ORGANIZATION** 1.1 Explain the purpose of an organization. 1.2 Define management organization. 1.3 Describe various types and features of organization structures. 1.4 Explain authority, responsibility, duties and delegation of authority. 1.5 Define span of supervision.	2	4
2.	**FUNDAMENTALS OF MANAGEMENT** 2.1 Explain the functions of management. 2.2 Relate administration, organization and management. 2.3 Describe different types of management and in which context they apply. 2.4 Define the specificities of industrial management.	2	4
3.	**PRODUCTION MANAGEMENT** 3.1 Define production management . 3.2 State functions of production management. 3.3 Describe "5p". 3.4 Mention applications of "5p". 3.5 Define cost control-methods. 3.6 Define inventory & inventory control. 3.7 Describe the fundamentals of maintenance management. 3.8 Explain the importance of quality system. 3.9 Explain the components of quality system	5	8
4	**PRODUCTIVITY IMPROVEMENT** 4.1 Define Productivity. 4.2 List factors affecting industrial productivity. 4.3 Describe productivity improvement techniques. 4.4 Describe the lean manufacturing approach. 4.5 Explain the concept of Just in Time.	3	6
5	**PLANNING** 5.1 Discuss importance of planning. 5.2 Explain the steps in planning. 5.3 Explain the factors affecting on planning. 5.4 State different types of production planning and control. 5.5 Describe the way to manage personal time.	4	7
6	**SUPPLY CHAIN MANAGEMENT**	3	4

Unit	Topics with Contents	Class (1 Period)	Final Marks
	6.1 Define supply chain management. 6.2 Explain the components of supply chain management. 6.3 Explain production integration into supply chain management.		
7.	**HUMAN RESOURCES MANAGEMENT AND DEVELOPMENT (HRM-HRD)** 7.1 Describe the main functions in human resources management (HRM). 7.2 Describe the main functions in human resources development (HRD). 7.3 Explain the role of manager in the recruitment process. 7.4 Explain the role of manager in the training process. 7.5 Explain the role of manager in the performance management system. 7.6 Mention the components of compensation and benefits system.	3	6
8.	**LEADING A TEAM** 8.1 Define leadership. 8.2 Identify personality traits impacting leadership style. 8.3 Discuss the types of leadership. 8.4 Define motivation and motivational cycle. 8.5 State the importance of motivation. 8.6 List motivation drivers based on Maslow, Herzberg adapted to various generations 8.7 State concepts of Theory-X, Theory-Y and Theory-Z	3	6
9.	**WORK ASSIGNMENT** 9.1 List different types of leadership styles. 9.2 Describe the leadership style adapted to the work assignment and delegation. 9.3 State SMART goal. 9.4 Set SMART goals to support work assignment. 9.5 Identify ways to reduce resistance to change during work assignment.	4	8
10.	**PROBLEM SOLVING AND DECISION MAKING** 10.1 Mention the steps of problem solving. 10.2 Explain tools used to analyze and solve problem addressing the 5M components. 10.3 Define decision making. 10.4 Discuss different types of decision-making process. 10.5 Describe the steps in decision making.	3	7
	Total	**32**	**60**

Necessary Resources (Tools, equipment and Machinery):

SI	Item Name	Quantity (piece/s)
01	Case studies, examples, exercises related documents	One for each student
02	Project templates	One for each student

Recommended Books:

SI	Book Name	Writer Name	Publisher Name & Edition
01.	Principles of Management	Dr. Md. Mainul Islam and Dr. Abdul Awal Dhan,	Bangladesh Open University.
02.	Personnel Management and Industrial Relation.	Mohammad Mohiuddin	NIDS Publication Co, Dhaka.
03.	Production Operations Management: The Handbook	Ronald P Bizzle Jr	Independently published (January 31, 2023)
04.	How To Implement Lean Manufacturing, Second Edition 2nd Edition	Lonnie Wilson	McGraw Hill; 2nd edition (March 22, 2015)
05.	The Toyota Way, Second Edition: 14 Management Principles from the World's Greatest Manufacturer Hardcover	Jeffrey K. Liker	McGraw Hill; 2nd edition (December 1, 2020)
06.	Faster, Better, Cheaper in the History of Manufacturing 1st Edition	Christoph Roser	Productivity Pr; 1st edition (August 5, 2016)
07.	Supply Chain Management, Inventory Control, Human Resource Management, and Customer service (Louis Bevoc Series of Educational and Informational Books)	Louis Bevoc	CreateSpace Independent Publishing Platform (September 4, 2016)
08.	Bulletproof ProblemSolving: The One Skill That Changes Everything	Charles Conn	Wiley; 1st edition (March 6, 2019)
09.	The Miniature Guide to Critical Thinking Concepts and Tools	Richard Paul and Linda Elder	The Foundation for Critical Thinking; Eighth edition (September 20, 2019)
10.	Leadership and the One Minute Manager: Increasing Effectiveness Through Situational Leadership	Ken Blanchard, Patricia Zigarmi, Drea Zigarmi	William Morrow; Updated edition (October 15, 2013)
11.	Effective Delegation of Authority: A (Really) Short Book for New Managers	Hassan Osman	Independently published (May 7, 2019)
12.	The Human Element: Overcoming the Resistance That Awaits	Loran Nordgren, David Schonthal	Wiley; 1st edition (September 28, 2021)
13.	The 7 Habits of Highly Effective People	Stephen R. Covey	Free Press (1989)
14.	ব্যবস্থাপনা	মোহাম্মদ খালেকুজ্জামান	দি যমুনা পাবলিশার্স
16.	কলেজে আরও ভালো কীভাবে করা যায়	সম্পাদকমণ্ডলী	নায়েম, ঢাকা

| 17. | শিল্প প্রতিষ্ঠান উৎকর্ষ অর্জন | সম্পাদকমণ্ডলী | নায়েম, ঢাকা |

Website References:

SI	Web Link	Remarks
01.	www.coachinforleaders	Podcast on leadership skills
02.	https://essentialcomm.com/	Podcast on coaching
03.	https://www.manager-tools.com/	Podcast on management
04.	https://www.shrm.org/	Website of the most important HR association in USA
05.	https://www.makingchips.com/	Podcast on manufacturing

Subject Code	Subject Name	Period per Week		Credit
26751	**Generation of Electrical Power**	T	P	C
		3	**3**	**4**

Rationale	Diploma in Engineering Level students are required to acquire the knowledge and skill on the area of Generation of Electrical Power with special emphasis of basic concept of power and energy, Renewable energy sources, Different types of power generating system & power plants, Boiler and National authority of electrical power. Generation of electrical power is a subject where a student will deal with Renewable energy sources, Power plants, Boiler, Steam power plant, Diesel power plant, Gas turbine power plant, Hydro-electric power plant, Nuclear power plant, Power plant economics, Wind power generation, Energy cell, Biomass and geothermal generation, Wave, Tidal and Ocean thermal generation. Such knowledge of the pre-requisite for these fields will help the student for effective discharge of their duties and it has been given more emphasis on practical aspect rather than theory in teaching learning approach.
Learning Outcome (Theoretical)	After Completing the subject, students will be able to: 1. Outline the concept of power and energy 2. Illustrate Renewable energy sources 3. Interpret Boiler and Stream power plant 4. State Diesel, Hydro-electric and Nuclear power plant 5. Explain Gas turbine power plant 6. Analyze Power plant economics 7. State Wind, Wave, Tidal and Ocean thermal power generation 8. Interpret Energy cell, Biomass and geothermal generation 9. Describe different Authority of electrical power
Learning Outcome (Practical)	After undergoing the subject, students will be able to: 1. Locate main power plants in Bangladesh 2. Choose a particular power plant 3. Inspect a boiler 4. Operate a diesel generator 5. Visit a steam power plant 6. Plot load curve and load duration curve 7. Measure voltage and current of solar panel 8. Sketch wind power plant 9. Measure voltage and current of fuel cells 10. Download video clips and document of renewable energy

Detailed Syllabus (Theory)

UNIT	TOPICS WITH CONTENTS	CLASS (1 PERIOD)	FINAL MARKS
1	**POWER AND ENERGY** 1.1 State the sources of Electrical Power. 1.2 List the common sources of Power. 1.3 Describe the different types of Power. 1.4 Discuss conventional sources of Power. 1.5 Discuss non-conventional sources of Power. 1.6 Mention the conventional sources of power in Bangladesh with locations. 1.7 Describe the different sources of renewable energy. 1.8 State the environmental, economic and political impacts of renewable energy systems in Bangladesh. 1.9 List the promising practices of renewable energy in home and abroad.	2	4
2	**RENEWABLE ENERGY SOURCES** 2.1 List Renewable Energy sources. 2.2 Discuss potential renewable Energy sources of Bangladesh. 2.3 Discuss different types of solar cell. 2.4 Explain the operating principle of solar cell. 2.5 Describe measurement of solar radiation and solar radiation at earth surface. 2.6 List the uses of solar radiation. 2.7 Explain the uses of solar P-V submersible water pumping, solar cooker, solar P-V home lighting for rural application, solar P-V charging station, solar P-V powered Refrigerator, solar dryer and commercially used generation of electrical energy.	2	5
3	**POWER PLANTS** 3.1 State the concept of power plant engineering. 3.2 Describe the basic operation of a power plant. 3.3 Explain the importance of power plants. 3.4 Name the different types of power plants. 3.5 Mention the different power plants of Bangladesh with location and rating.	2	4
4	**BOILER** 4.1 Define Boiler. 4.2 Explain the different types of Boilers. 4.3 Describe the construction and working principle of water tube boiler. 4.4 Discuss the construction and working principle of fire tube boiler. 4.5 Compare between water tube and fire tube boiler. 4.6 Explain the working principle of boiler auxiliaries and accessories. 4.7 Discuss the feed water treatment process.	4	8

5	**STEAM POWER PLANT**	4	8
	5.1 Explain the working principle of a steam power plant.		
	5.2 Enumerate the different types of vapour cycle with P-V diagram.		
	5.3 Describe the different types of steam generator.		
	5.4 Explain the working principle of steam generator.		
	5.5 Describe the working principle of different types of steam turbine including starting and shutdown procedure.		
	5.6 Sketch a schematic diagram of a steam power plant.		
	5.7 Describe coal handling process of a steam power plant.		
	5.8 Describe combined cycle power plant.		
6	**DIESEL POWER PLANT**	4	8
	6.1 Explain the working principle of a Diesel power plant.		
	6.2 Mention the areas of application of diesel power plant.		
	6.3 Describe the constructional features of a modern diesel engine used for a diesel generating station.		
	6.4 Point out starting and stopping procedure of a diesel power plant.		
	6.5 Illustrate the fuel storage and handling method for large scale diesel power plant.		
	6.6 List the advantages and disadvantages of a Diesel power plant.		
7	**GAS TURBINE POWER PLANT**	4	8
	7.1 Explain working principle of simple open cycle gas turbine with P-V diagram.		
	7.2 Describe working principle of simple closed cycle gas turbine with P-V diagram		
	7.3 Mention the different types of Gas turbine.		
	7.4 Sketch a schematic diagram of a gas turbine power plant.		
	7.5 Mention the location of gas turbine power plants in Bangladesh.		
	7.6 List the advantages and disadvantages of a gas turbine power plant.		
8	**HYDRO-ELECTRIC POWER PLANT**	4	8
	8.1 Explain the working principle of a hydro-electric power plant.		
	8.2 Define catchment area.		
	8.3 Interpret different sections of a hydro-electric power plant with schematic diagram.		
	8.4 Describe different types of water turbine generally used in hydro-electric plant.		
	8.5 Explain the governing principle of a water turbine with a schematic diagram.		
	8.6 List the advantages and disadvantages of Hydro-electric power plant.		
	8.7 Solve problems related to hydro-electric power plant.		
9	**NUCLEAR POWER PLANT**	4	8
	9.1 Explain the elements of a nuclear power plant with schematic diagram.		

	9.2	Illustrate the chain reaction.		
	9.3	Mention four types of reactors used in a nuclear power plant.		
	9.4	Explain the constructional features of each type of reactor.		
	9.5	Describe the working principle of each type of reactor.		
	9.6	List the advantages & disadvantages of nuclear power plant.		
	9.7	List large nuclear power plants in the world.		
	9.8	Analyze the nuclear power plant established in Bangladesh.		
10	**POWER PLANT ECONOMICS**		3	8
	10.1	Mention the considering factors for selecting the site of a steam, diesel, hydro-electric, gas turbine and nuclear power plant.		
	10.2	Sketch the different power plants of Bangladesh with types, capacities and location in a map.		
	10.3	Describe peak and off-peak load, Base load, Average load, connected load, Maximum load, Load factor, Demand factor, Use factor, Capacity factor, Diversity factor, Plant factor, plant depreciation, Ideal and actual load curve, annual load curve, load dispatch center, load scheduling and load management.		
	10.4	List the factors influencing the rate or tariff designing of electrical energy.		
	10.5	Describe the different methods of rate or tariff for electrical energy.		
	10.6	State the operating costs of a Steam, Diesel, and Gas power plant.		
	10.7	Describe the operating costs of a hydro-electric and nuclear power plant.		
	10.8	Point out the advantages of interconnection of different power plants.		
	10.9	Solve problems related to power plant economics.		
11	**WIND ENERGY GENERATION**		3	4
	11.1	Discuss wind energy conversion system.		
	11.2	Interpret small scale, intermediate scale and large-scale system of wind energy generation.		
	11.3	Describe the different components of wind machine.		
	11.4	Illustrate different types of wind machines.		
	11.5	Discuss different types of wind energy conversion system.		
	11.6	Point out wind energy prospects of Bangladesh for coastal regions.		
12	**ENERGY CELL**		4	4
	12.1	Discuss the basic principles of Photovoltaic cell and fuel cell.		
	12.2	Mention the types of Photovoltaic cell and Fuel cell.		
	12.3	Describe the photo voltaic energy conversion system.		
	12.4	Mention the applications of Photovoltaic cell and Fuel cell in Residential, Community and Central station.		
	12.5	Explain the solid acid fuel cell (SAFC), phosphoric acid fuel cell (PAFC) and alkaline fuel cell (AFC).		

	12.6	Describe Sodium ion cell (SIC) and Hydrogen fuel cell (HFC).		
	12.7	Mention the uses of SAFC, PAFC, AFC, SIC, HFC, PEMFC, SOFC, MCFC and AFC.		
13	**BIOMASS AND GEOTHERMAL ENERGY GENERATION**		3	4
	13.1	Discuss Biomass energy system.		
	13.2	Mention the sources of Biomass.		
	13.3	List the Biomass yields.		
	13.4	Explain Thermal and Chemical Biomass conversion system.		
	13.5	Describe Biochemical and Electrochemical conversion system.		
	13.6	Discuss the Geothermal energy.		
	13.7	Describe different types of Geothermal energy.		
	13.8	Explain Geothermal electricity production and Geothermal heat pumps.		
14	**WAVE, TIDAL AND OCEAN THERMAL ENERGY**		3	5
	14.1	Describe wave energy generation.		
	14.2	Describe tidal energy generation.		
	14.3	Describe Ocean thermal energy conversion (OTEC).		
	14.4	State the Municipal Solid Waste-to-Energy.		
	14.5	State the working procedure of waste to energy plant with block diagram.		
	14.6	List the advantages of Waste-to-Energy for Municipal Solid Waste.		
	14.7	State the challenges and remedies to implement renewable energies.		
15	**AUTHORITY OF ELECTRICAL POWER**		2	4
	15.1	List the authorities of power supply in Bangladesh.		
	15.2	Explain grid system.		
	15.3	List the functions of public & private sector in the field of power generation in Bangladesh.		
	15.4	Explain the responsibilities of Bangladesh Energy Regulatory Commission.		
	15.5	Draw the organogram of Rural Electrification Board (REB) and BPDB with consumers.		
	15.6	Describe the operation of DPDC, WZPDC, NWPGCO, NWPDCO, EGCB, RPCL and APSCO.		
	15.7	Point out the jurisdiction of Dhaka Electric Supply Company (DESCO).		
	15.8	Mention the function and jurisdiction of Power Grid Company of Bangladesh (PGCB).		
	15.9	Describe the existing private sector power station in Bangladesh and future growth.		
		TOTAL	**48**	**90**

Detailed Syllabus (Practical)

SL.	EXPERIMENT NAME WITH PROCEDURE	CLASS (3 PERIOD)	CONTINUOUS MARKS
1	**LOCATE THE MAIN POWER PLANTS OF BANGLADESH WITH SOURCES OF NATURAL ENERGY BY TRACING A MAP OF BANGLADESH.** 1.1. Trace a map of Bangladesh showing important places. 1.2. Locate the power plants and power sources symbolically in the map. 1.3. Identify the power plants and power sources with location. 1.4. Indicate the rivers adjacent to the power plants. 1.5. Show the legends demonstrating the symbols.	1	2
2	**JUSTIFY A PARTICULAR POWER PLANT FOR AN AREA** 2.1. Survey the electrical load of the area to be electrified by the power plant. 2.2. Identify the types of power plant. 2.3. Select a power plant on the basis of economy of the sources and fuel available. 2.4. Specify the size of the power plant on the basis of load survey. 2.5. Determine generating voltage of the power plant on the basis of distribution. 2.6. Justify the reasons for the selection made. 2.7. Maintain the record of performed task.	1	3
3	**INSPECT A BOILER** 3.1. Select an Industry where Boiler is available. 3.2. Arrange to visit and inspect the industry 3.3. Observe and Read nameplate & the manual carefully. 3.4. Identify different parts of that boiler. 3.5. Sketch a neat diagram showing all parts of the boiler. 3.6. Maintain the record of performed task.	2	3
4	**OPERATE A DIESEL GENERATOR** 4.1. Collect the required instruments and diesel generator. 4.2. Check all accessories. 4.3. Check fuel level. 4.4. Start and run the generator at no load. 4.5. Increase load gradually and measure voltage & frequencies. 4.6. Record all readings. 4.7. Maintain the record of performed task.	2	3
5	**INSPECT STEAM POWER PLANT** 5.1. Select a steam power plant. 5.2. Arrange to visit and inspect the power plant. 5.3. Observe the boiler and feed water system. 5.4. Inspect turbine and alternator section. 5.5. Observe switchgear and control system. 5.6. Make a chart including feed water source, fuel type, boiler type, boiler capacity, steam pressure and	2	3

	temperature, type of turbine, turbine RPM, governing system, generating voltage and capacity 5.7. Maintain the record of performed task.		
6	**PLOT THE LOAD CURVE AND LOAD DURATION CURVE OF A POWER PLANT.** 6.2. Collect data of a particular power plant. 6.3. Process collected data of a particular power plant for a given period. 6.4. Plot a load curve according to the processed data and locate peak load from load curve. 6.5. Plot a load duration curve according to the processed data and show the peak hour. 6.6. Calculate the load factor, utility factor, use factor and plant factor. 6.7. Maintain the record of performed task.	2	3
7	**MEASURE VOLTAGE AND CURRENT FOR SERIES AND PARALLEL COMBINATION OF SOLAR PANEL.** 7.1. Select the appropriate solar panel, Battery, Cable, multi-meter etc. 7.2. Connect the three or more solar panel in series. 7.3. Record data in the table 7.4. Connect the three or more solar panel in parallel. 7.5. Record data in the table. 7.6. Maintain the record of performed task.	1	2
8	**PREPARE A NEAT INTEGRATED SKETCH OF A WIND POWER PLANT** 8.1. Identify prominent wind power plant in the world. 8.2. Identify wind power plant in Bangladesh. 8.3. Identify necessary components and parts of a wind power plan. 8.4. Identify the different sections of the plant. 8.5. Draw the layout diagram of wind power plant.	2	2
9	**MEASURE THE VOLTAGE OF VARIOUS FUEL CELL** 9.1. Select available fuel cell, Battery, Cable, multi-meter. 9.2. Record the data before charging. 9.3. Connect the alkaline fuel cell (AFC) with a charger. 9.4. Record the data after charging. 9.5. Maintain the record of performed task.	1	2
10	**DOWNLOAD AND PRESENT VIDEO CLIPS FOR DIFFERENT TYPES OF NON-CONVENTIONAL ENERGY.** 10.1. Search clips of non-conventional energy. 10.2. Download clips of non-conventional energy. 10.3. Present the video clips of each non-conventional energy. 10.4. Maintain the record of performed task.	2	2
	Total	**16**	**25**

Resources (Tools, equipment, Materials and Machineries):

SI	Item Name	Quantity
01	Screw drivers, Neon tester, Standard Wire Gauge (SWG), Hammer, Mallat	Each item 25 no's
02	Ammeter, Voltmeter, Ohm meter, AVO meter, Multimeter Wattmeter	Each item 10 no's
03	Voltaic cell, Fuel cell, Ampere Tube, Cotton tap,	Each item 08 no's
04	Battery charging Unit, Diesel generator, Motor generator trainer, Solar panel, Battery	5 no's
05	Two pin socket, Combined switch and socket, two pin plug	Each item 10 no's
06	Dc power supply unit, Voltage stabilizer	Each item 10 no's
07	Dry cells (1.5v, 2.2v, 3.0v, 6.0v, 9.0v), Graph papers	Each item 10 no's

Reference books:

SI	Book Name	Writer Name	Publisher Name & Edition
01	Power Plant Engineering	G R Nagpal	Khanna publisher, 2007
02	Power Plant Engineering –	Morse Fredrick T	VAN NOSTRANDREINHOLD 3rd Edition
03	A Course in Power Plant Engineering	S Domkunowar	Dhanpat Rai,1984
04	Principle of Power System	V K Mehta	S Chand & Company, 2005
05	Hand Book of Energy Technology, Trends and Prospections	Hunt ,V Daniel	VAN NOSTRANDREINHOLD 1st Edition
06	Renewable Engineering Sources and Conversion Technology	NK Bansal, Manufred klee mann Michel (Megam Hill)	Tata Mcgraw- Hill, 1990
07	Renewable energy. Technology, economics and environment;	Martin Kaltschmitt	Springer-Verlag Berlin Heidelberg, 2007
08	Renewable Electricity and the Grid	Godfrey Boyle	Edited: Newspapers and books 2021
09	Solar Electricity Handbook	IPCC	Green stream, 2016

Website References:

SI	Web Link	Remarks
01	http//www.electricalengineering.org	
02	http//www.eetiimes.eu	
03	http//www.interestingengineering .com	

SUBJECT CODE	SUBJECT NAME	PERIOD PER WEEK		CREDIT
		T	P	C
26752	**ELECTRICAL AND ELECTRONIC MEASUREMENT-1**	**2**	**3**	**3**

Rationale	Electrical and Electronic measurement-1 deals with the measuring instruments of measurement of electrical and electronic quantities and its applications. It works with various types of measurement such as current, voltage, power and energy by using analog as well as digital measuring instruments. It computes accuracy, precision, sensitivity and error in electrical measuring instruments, Concept of operation of different types of electrical measuring instruments, measurement of power and energy of single phase and three phase system, Concept of operation of analog and digital voltmeter and energy meter. Electrical and Electronic measurement-1 is a field of study within measurement that investigates the principal and working process of electrical and electronic measuring instruments. The students should acquire knowledge, skills and attitude regarding concept of measurement, classification of measuring instruments, principle of operation of different types of measuring instruments such as ammeter, voltmeter, wattmeter, energy meter and digital voltmeter and digital energy meter.
Learning Outcome (Theoretical)	**After undergoing the subject, students will acquire on** • Explain the Concept of measurements • State Classification of measuring instruments • Describe Principle of operation of indicating instruments • Discuss constructional feature of measuring instruments • Interpret moving iron and Moving coil instruments • Point out Operation of wattmeter • Conclude Operation and testing of energy meter • Explain Digital instrument and digital display • Illustrate constructional feature of digital voltmeter and digital energy meter
Learning Outcome (Practical)	**After undergoing the subject, students will be able to** 1. Practice the operation of indicating, integrating, recording and digital instruments. 2. Disassemble and reassemble of ammeter and voltmeter. 3. Study the wattmeter. 4. Measure the single phase and three phase power. 5. Measure the single phase and three phase energy. 6. Test the energy meter for finding its error.

DETAILED SYLLABUS (THEORY)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	**CONCEPT OF MEASUREMENTS** 1.1 Define measurements of electrical quantities. 1.2 Discuss significance of measurements. 1.3 Describe accuracy, precision, sensitivity and resolution or discrimination. 1.4 Distinguish between accuracy and precision. 1.5 Mention the errors in measurements. 1.6 State true value, loading effect, static error or absolute error, relative error, static correction, limiting error and percentage limiting error. 1.7 Describe the loading effects due to shunt connected instruments. 1.8 Explain the loading effects due to series connected instruments. 1.9 Solve the problems related to errors in measurement.	02	04
2	**CLASSIFICATION OF MEASURING INSTRUMENT** 2.1 Describe measuring instrument. 2.2 Name different types of measuring instruments. 2.3 Describe absolute and secondary instruments. 2.4 List secondary instruments according to their mode of operation and functions. 2.5 Explain indicating, recording and integrating instruments. 2.6 Describe the various effects of current or voltage utilized in measuring instrument upon which their operation depends.	02	04
3	**PRINCIPLE OF OPERATION OF INDICATING INSTRUMENTS** 3.1 List different types of torque applied in indicating instrument which act upon their moving system. 3.2 Describe deflecting torque and controlling torque. 3.3 Explain spring control and gravity control system. 3.4 Distinguish between spring control and gravity control system. 3.5 Explain damping torque. 3.6 State different types of damping systems. 3.7 Compare among air friction, fluid friction and eddy current damping 3.8 Solve the problems related to spring control and gravity control system.	03	06

4	**CONSTRUCTIONAL FEATURES OF MEASURING INSTRUMENTS** 4.1 Name the essential parts of measuring instruments. 4.2 Mention the parts of the instrument. 4.4 Describe supporting system, moving system, balancing, permanent magnets, pointer, scale, zero-adjuster and cases. 4.3 Discuss the torque weight ratio. 4.4 Explain the principle operation of ammeter and voltmeter. 4.5 Distinguish between the working principle of ammeter and voltmeter. 4.6 List the various types of ammeters and voltmeter.	**02**	**06**	
5	**MOVING IRON INSTRUMENTS** 5.1 Describe the construction and working principle of moving iron attraction type instruments. 5.2 Derive the torque equation of moving iron attraction type instruments. 5.3 Describe the construction and working principle of repulsion type moving iron instrument. 5.4 Derive the torque equation of repulsion type moving iron instrument. 5.5 List the advantages and disadvantages of moving iron instruments. 5.6 Discuss errors in moving iron instruments. 5.7 Solve the problems related to of moving iron instruments.	**04**	**06**	
6	**MOVING COIL INSTRUMENTS** 6.1 Describe the construction and working principle of permanent magnet moving coil instruments. 6.2 Derive the torque equation of the moving coil instrument. 6.3 Mention the advantages and disadvantages of permanent magnet moving coil instruments. 6.4 Describe the construction and working principle of dynamometer type moving coil instruments. 6.5 Summarize the arrangement of coils of dynamometer type instruments for measurements of current and voltage. 6.6 Discuss the errors of moving coil instruments. 6.7 Solve the problems related to torque equation of moving coil instruments.	**04**	**06**	
7	**OPERATION OF WATTMETER** 7.1 Describe the construction and principle of operation of dynamometer type wattmeter.	**03**	**06**	

	7.2 List the advantages of dynamometer type wattmeter. 7.3 Mention the disadvantages of dynamometer type wattmeter. 7.4 Describe the construction of induction type wattmeter. 7.5 Describe the principle of operation of induction type wattmeter. 7.6 List the advantages of induction type wattmeter. 7.7 List the disadvantages of induction type wattmeter 7.8 Compare between induction wattmeter and dynamometer wattmeter.		
8	**ELECTRICAL POWER MEASUREMENT** 8.1 List the method for the measurement of power in three phase circuit. 8.2 Explain the errors involved in connecting wattmeter in a single-phase circuit. 8.3 Mention the function of compensating coil in wattmeter connection. 8.4 Describe the method for measurement of three phase power by two wattmeter. 8.5 Derive the equation for power and power factor in two wattmeter method. 8.6 Describe the method of three phase power measurement by one watt meter. 8.7 Describe the method of 1-Φ reactive power measurement by single phase VAR meter. 8.8 Describe the method of 3- Φ reactive power measurement. 8.8 Solve the problems for the calculation of power and power factor.	**03**	**04**
9	**OPERATION AND TESTING OF ENERGY METER** 9.1 Describe the principle of operation of energy meter. 9.2 List the different types of energy meter. 9.3 Explain the working principle of motor meter. 9.4 Describe the construction and working principle of mercury motor meter. 9.5 Describe working principle of poly phase induction type energy meter. 9.6 Sketch the connection diagram of poly phase induction type energy meter. 9.7 Describe the necessity of testing of energy meter. 9.8 List the apparatus required for testing of energy meter. 9.9 State the methods of testing of energy meter.	**03**	**06**

10	**DIGITAL INSTRUMENT AND DIGITAL DISPLAY**	03	06
	10.1 Explain the principle of operation of digital instruments.		
	10.2 Describe the advantages of digital instruments.		
	10.3 Compare between digital instruments and Analog instruments.		
	10.4 Mention the different types of digital display system.		
	10.5 Describe seven segment display and 3×5 dot matrix display.		
	10.6 Explain the construction of liquid crystal display.		
	10.7 Express the operation of gas discharge plasma display.		
	10.8 Explain resolution in digital meter and sensitivity of digital meters.		
11	**CONCEPT OF DIGITAL VOLTMETER AND DIGITAL ENERGY METER**	03	06
	11.1 Explain the operation of transistor voltmeter (TVM).		
	11.2 Describe the operation of ramp type digital voltmeter (RDVM).		
	11.3 Enumerate the operation of successive approximation digital voltmeter.		
	11.4 Describe the principle of operation of digital single phase energy meter		
	11.5 Describe the block diagram of a digital single phase energy meter		
	11.6 Explain the principle of operation of digital three phase energy meter		
	11.7 Describe the block diagram of a digital three phase energy meter.		
	11.8 Explain the basic information about prepaid metering system.		
	Total	**32**	**60**

DETAILED SYLLABUS (PRACTICAL)

Sl.	Experiment Name	Class (3 Period)	Marks (Continuous)
1	**OBSERVE THE OPERATION OF INDICATING, INTEGRATING, RECORDING AND DIGITAL INSTRUMENTS.** 1.1 Choose one indicating, one integrating, one recording and one digital instrument. 1.2 Select the tools and materials required. 1.3 Connect each instrument to the supply system	2	3

	with proper load, if necessary. 1.4 Observe the operation of moving system of each instrument. 1.5 Maintain the record of the performed task.			
2	**DISASSEMBLE AND REASSEMBLE OF AMMETER AND VOLTMETER** 2.1 Collect ammeters and voltmeters. 2.2 Collect required numbers of tools to open ammeters and voltmeter. 2.3 Disassemble the parts of the instrument. 2.4 Identify the controlling and damping system. 2.5 Identify the parts of the meter. 2.6 Identify the types of meters. 2.7 Reassemble the meters 2.8 Maintain the record of the performed task.	2	3
3	**STUDY THE WATTMETER** 3.1 Select proper tools and wattmeter. 3.1 Disassemble the different parts of the wattmeter. 3.3 Identify the different parts of the wattmeter. 3.4 Identify the type of wattmeter. 3.5 Reassemble the wattmeter. 3.6 Maintain the record of the performed task.	1	2
4	**MEASURE THE SINGLE-PHASE POWER BY AMMETER, VOLTMETER AND WATTMETER** 4.1 Sketch the circuit diagram for measuring single phase power by ammeter, voltmeter and wattmeter. 4.2 List and collect tools, equipment and materials required. 4.3 Prepare the circuit according to the circuit diagram using necessary equipment. 4.4 Check the circuit before energizing. 4.5 Record the meter readings. 4.6 Calculate the power and power factor from the data obtained. 4.7 Determine error from calculation. 4.8 Draw vector diagram from the data obtained. 4.9 Maintain the record of the performed task.	2	3
5	**MEASURE THE THREE PHASE POWER BY TWO WATTMETER METHOD** 5.1 Draw the circuit diagram for measuring power by two wattmeter of a three-phase system. 5.2 List and collect tools, equipment and materials for the experiment. 5.3 Prepare the circuit according to the circuit diagram using required equipment.	1	3

	5.4 Check the circuit before energizing. 5.5 Record the reading from the meters. 5.6 Calculate the power and power factor. 5.7 Determine error from calculation. 5.8 Draw vector diagram using relevant data as obtained. 5.9 Maintain the record of the performed task.			
6	**MEASURE THE THREE PHASE POWER BY ONE WATTMETER METHOD** 6.1 Sketch the circuit diagram for measuring power by one wattmeter of a three-phase system. 6.2 List and collect tools, equipment and materials for the experiment. 6.3 Prepare the circuit according to the circuit diagram using proper equipment. 6.4 Check the circuit before energizing it. 6.5 Record the reading from the meter. 6.6 Calculate the power. 6.7 Draw vector diagram using relevant data as obtained. 6.8 Maintain the record of performed task.	2	2	
7	**MEASURE THE ENERGY OF A THREE PHASE CIRCUIT BY A THREE PHASE ENERGY METER** 7.1 Sketch the circuit diagram for measuring energy by three phase's energy meter of a three-phase system. 7.2 List and collect tools, equipment and materials for the experiment. 7.3 Prepare the circuit according to the circuit diagram using proper equipment. 7.4 Check the circuit before energizing it. 7.5 Record the reading from the meter. 7.6 Calculate the energy. 7.7 Maintain the record of performed task.	1	2	
8	**TEST AN ENERGY METER FOR FINDING ITS ERROR** 8.1 Draw the circuit diagram for testing an energy meter. 8.2 Select an energy meter and one wattmeter. 8.3 Select and collect tools, equipment and materials for the experiment. 8.4 Prepare the circuit according to the circuit diagram. 8.5 Record reading from the meter. 8.6 Calculate the error from the reading. 8.7 Maintain the record of performed task.	2	2	

9	**MEASURE THE ENERGY OF A SINGLE PHASE CIRCUIT BY SINGLE PHASE DIGITAL ENERGY METER** 9.1 Sketch the circuit diagram for measuring energy of a single phase circuit by single phase digital energy meter. 9.2 List and collect tools, equipment and materials for the experiment. 9.3 Prepare the circuit according to the circuit diagram using proper equipment. 9.4 Check the circuit before energizing it. 9.5 Record the reading from the meter. 9.6 Maintain the record of performed task.	1	2
10	**MEASURE THE ENERGY OF A THREE PHASE CIRCUIT BY THREE PHASE DIGITAL ENERGY METER** 10.1 Sketch the circuit diagram for measuring energy of a three phase circuit by three phase digital energy meter 10.2 List and collect tools, equipment and materials for the experiment. 10.3 Prepare the circuit according to the circuit diagram using proper equipment. 10.4 Check the circuit before energizing it. 10.5 Record the reading from the meter. 10.6 Maintain the record of performed task.	2	3
	Total	**16**	**25**

NECESSARY RESOURCES (TOOLS, EQUIPMENT'S AND MACHINERY):

Sl	Item Name	Quantity
01	Screw driver (Flat and Star of different sizes)	20nos
02	Pliers (Nose and combination)	10 nos
03	Neon Tester	10nos
04	Ammeter	5 nos
05	Voltmeter	5 nos
06	Wattmeter	5 nos
07	Energy meter	As Necessary
08	Digital voltmeter	As Necessary
O9	Digital energy meter	As Necessary

RECOMMENDED BOOKS:

Sl	Book Name	Writer Name	Publisher Name & Edition
01	Electrical Measurement and Measuring Instruments	U.A. Bakshi, A.V Bakshi.	Technical publications
02	Electrical Measurement and Measuring Instrument	M.L. Anand	S chand
03	Measurement & Measuring Instruments	Golding	Tata macgrohill
04	A course in Electrical andElectronic measurements and instrumentation	A. K. Sawhney.	Dhanpate Raj & company.
05	Electrical and Electronic measurement and instrumentation	G.N Srinivas and S Narayan Singha	BS publications
06	Electrical and electronic measurement and Instrumentation	R. K Rajput	S chand

WEBSITE REFERENCES:

Sl	Web Link	Remarks
01	www.youtube.com	Search here with topics
02	PDF drive .con	Search here with topics
03	www.google.com	Search here with topics
04	www. techarana360.com	Search here with topics

SUBJECT CODE	SUBJECT NAME	PERIODPER WEEK		CREDIT
		T	P	C
26753	**Testing and Maintenance of Electrical Equipment**	2	3	3

Rationale	Diploma in engineering level students is required to acquire the knowledge and skills on the area of Testing and Maintenance of Electrical Equipment. It is one of the most important subject in respect to provide the students opportunities to acquire knowledge, skill and attitude in the area of testing and maintenance of electrical equipment with the special emphasizes on: Trouble shooting and Maintenance of electrical equipment, Faults findings and remedy the faults of Battery, DC Generators, DC motors, Faults findings and remedy the troubles of Transformers, Induction motors, Auto Star-Delta starter, Forward-Reverse (3 - Phase) motor starter, Magnetic contact, Over Load Relay (OLR), Test trip , 3 -Phase motor reverse rotation, Phase Sequence change, Alternator Faults findings and remedy the troubles of Synchronous motor and Circuit breaker, Power factor improvement unit (PFI), Solar system maintenance.
Learning Outcome (Theory)	**After Completing the subject, students will be able to:** 1. Find the troubles of battery, DC generators and DC motor. 2. Describe the faults of single phase and three phase Transformer. 3. Outline the provable faults of single-phase induction motor. 4. Explain the faults of three phase induction motor 5. Explain the troubles of Alternator and Synchronous motors. 6. State the faults of Circuit breaker. 7. Illustrate the faults of Auto Star-Delta starter. 8. Explain the troubles of Overload Relay (OLR). 9. Discuss the troubles of power factor improvement unit (PFI). 10. State the faults of solar system.
Learning Outcome (Practicale)	**After undergoing the subject, students will be able to:** 1. Perform the different test of storage Battery. 2. Detect the causes of voltage build up failure of DC generator and failure of running of DC motor. 3. Perform routine test of Single phase and Three phase distribution Transformer. 4. Recognize the faults of Single phase and Three phase Induction motors. 5. Detect the faults of Auto Star-Delta Stater and Overload relay. 6. Detect the common faults of Alternator. 7. Detect the troubles of Synchronous motor. 8. Identify common faults of High Voltage circuit Breaker. 9. Perform the testing of power factor improvement unit (PFI) 10. Detect the faults of solar system.

DETAILED SYLLABUS (Theory)

Unit	Topics with content	Class (1 Period)	Final Marks
1	**BATTERY, DC GENERATOR AND DC MOTOR MAINTENANCE** 1.1. Mention the troubles of storage Battery. 1.2. Explain the troubles of storage Battery. 1.3. Describe the process of repair and maintenance of storage Battery. 1.4. List the faults of DC Generator and DC Motor. 1.5. Explain the faults of DC Generator and DC Motor. 1.6. Describe the repair and maintenance process of DC Generator and DC Motor.	4	8
2	**SINGLE AND THREE PHASE TRANSFORMER MAINTENANCE** 2.1 List the faults of single-phase Transformer. 2.2 Explain the faults of single-phase Transformer. 2.3 Describe the repair and maintenance procedure of single-phase Transformer. 2.4 Mention the faults of three phase Transformer. 2.5 Explain the faults of three phase Transformer. 2.6 Describe the repair and maintenance procedure of three phase Transformer.	4	8
3	**SINGLE PHASE INDUCTION MOTOR MAINTENANCE** 3.1 List the faults of single-phase Induction Motor. 3.2 Explain the faults of single-phase Induction Motor. 3.3 Describe the repair and maintenance procedure of ceiling fan. 3.4 Mention the repair and maintenance process of single-phase water pump set. 3.5 List the function of centrifugal switch of single-phase motor. 3.6 Explain the reason for fail to lifting water of centrifugal pump.	4	8
4	**THREE PHASE INDUCTION MOTOR MAINTENANCE** 4.1 List the faults of Three-phase Induction Motor. 4.2 Illustrate the faults of Three-phase Induction Motor. 4.3 Explain phase sequence, polarity change of coil and reverse rotation. 4.4 Describe the repair and maintenance process of Three-phase Induction Motor.	3	5
5	**ALTERNATORS AND SYNCHRONOUS MOTOR MAINTENANCE** 5.1 List the faults of Alternator. 5.2 Illustrate the faults of Alternator. 5.3 Describe repair and maintenance procedure of Alternator. 5.4 Mention the faults of Synchronous motor. 5.5 Explain the faults of Synchronous motor. 5.6 Explain the repair and maintenance procedure of	3	6

	Synchronous motor.		
6	**CIRCUIT BREAKER MAINTENANCE** 6.1 List the common faults of Circuit breaker. 6.2 Illustrate the faults of various Circuit breaker. 6.3 Describe the repair and maintenance process of Oil Circuit breaker.	3	5
7	**AUTO STAR-DELTA STARTER MAINTENANCE** 7.1 List the faults of Auto Star-Delta starter. 7.2 Illustrate the faults of Auto Star-Delta starter. 7.3 Describe repair and maintenance procedure of Auto Star-Delta starter.	3	5
7	**OVERLOAD RELAY (OLR) TROUBLESHOOTING** 8.1 List the faults of Overload Relay (OLR). 8.2 Illustrate the faults of Overload Relay (OLR). 8.3 Describe the repair and maintenance process of Overload Relay (OLR).	2	4
9	**POWER FACTOR IMPROVEMENT (PFI) UNIT USING CAPACITOR BANK** 9.1 List the faults of a power factor improvement unit (PFI). 9.2 Illustrate the faults of a power factor improvement unit (PFI). 9.3 Describe repair and maintenance procedure of a power factor improvement unit (PFI).	3	6
10	**SOLAR SYSTEM MAINTENANCE** 10.1 List the faults of solar system. 10.2 Illustrate the faults of solar system. 10.3 Describe repair and maintenance procedure of solar system.	3	5
	Total	**32**	**60**

DETAILED SYLLABUS (PRACTICAL)

Sl.	Experiment Name with procedure	Class (3 Period)	Marks (Continuous)
1	**PERFORM DIFFERENT TEST OF BATTERY** 1.1 Identify the probable test of storage Battery. 1.2 Draw the circuit diagram. 1.3 Collect tools and equipment. 1.4 Measure the emf of each cell of storage Battery. 1.5 Measure the specific gravity of the electrolyte of storage battery. 1.6 Record the reading of test data. 1.7 Maintain the record of performed task.	2	2
2	**FIND OUT THE FAULTS OF DC GENERATOR AND DC MOTOR** 2.1 Collect tools and equipment.	2	3

	2.2 Draw circuit diagram and connect for measuring emf. 2.3 Measure the emf of a DC generator. 2.4 Identify the reasons of failure of emf generation of DC generation. 2.5 Find the electrical faults of DC Motor. 2.6 Draw circuit diagram and connect for continuity test 2.7 Perform the continuity test of the DC motor. 2.8 Perform the short circuit test of DC Motor.		
3	**PERFORM ROUTINE TEST OF SINGLE AND THREE PHASE DISTRIBUTION TRANSFORMER** 3.1 Collect tools and equipment. 3.2 List the name of different test of a Transformer. 3.3 Draw circuit diagram and connect for continuity test of transformer. 3.4 Perform Winding Resistance & continuity test of a Transformer. 3.5 Perform Vector Group test of a Transformer. 3.6 Perform the Insulation resistance test of a Transformer. 3.7 Record the test data and result.	2	3
4	**FIND OUT THE FAULTS OF SINGLE AND THREE PHASE INDUCTION MOTOR.** 4.1 Identify common faults of an Induction Motor. 4.2 Identify mechanical faults of an Induction Motor. 4.3 Identify electrical faults of an Induction Motor. 4.4 Collect the tools and equipment for testing an Induction Motor. 4.5 Perform continuity test by using Megger, Avometer and Test lamp of an Induction motor. 4.6 Perform insulation resistance between two coils and between phase and earth test of an Induction motor.	2	3
5	**DETECT THE FAULTS OF AUTO STAR – DELTA STATER AND OVERLOAD RELAY** 5.1 Draw the circuit diagram of Auto Star-Delta starter. 5.2 Find out the faults of Auto Star-Delta starter. 5.3 Repair and maintenance of Auto Star-Delta starter.	1	2
6	**FIND OUT THE FAULTS OF AN ALTERNATOR** 6.1 Collect the tools and equipment for measuring emf. 6.2 Draw circuit diagram and connect for measuring emf. 6.3 Measure the emf of an Alternator. 6.4 Identify the reasons of failure of emf generation of an Alternator. 6.5 Identify the mechanical faults of an Alternator. 6.6 Identify the electrical faults of an Alternator.	1	2

7	**DETECT THE TROUBLES AND REMEDY THE TROUBLES SYNCHRONOUS MOTOR** 7.1 Identify the common faults of a Synchronous Motor. 7.2 Identify the mechanical faults of a Synchronous Motor. 7.3 Identify the electrical faults of a Synchronous Motor. 7.4 Collect the tools and equipment for testing an Induction Motor 7.5 Perform continuity test by using Megger, Avometer and Test lamp of a Synchronous motor. 7.6 Perform insulation resistance test between two coils and between phase and earth test of a Synchronous motor.	2	3
8	**FIND OUT THE FAULTS OF CIRCUIT BREAKER** 8.1 Identify the name of different test of a HV Circuit Breaker. 8.2 Collect the tools and equipment for testing the HV Circuit Breaker. 8.3 Draw circuit diagram and connect for insulation resistance test for CB. 8.4 Perform the Insulation resistance test by using megger. 8.5 Record the data and result of Insulation resistance test.	1	2
9	**FIND OUT THE FAULTS OF POWER FACTOR IMPROVEMENT (PFI) UNIT** 9.1 Draw the circuit diagram of power factor improvement unit (PFI)(Capacitor Banking system). 9.2 Find out the faults of power factor improvement unit (PFI) unit. 9.3 Repair and maintenance of power factor improvement unit (PFI) unit.	2	3
10	**FIND OUT THE FAULTS OF SOLAR SYSTEM.** 10.1 Draw the circuit diagram of solar system. 10.2 Find out the faults of solar system. 10.3 Repair and maintenance the solar system.	1	2
	Total	**16**	**25**

NECESSARY RESOURCES (TOOLS, EQUIPMENT'S AND MACHINERY):

Sl	Item Name	Quantity
01	Screw drivers, Neon tester, Standard Wire Gauge (SWG), Hammer, Mallat.	As Necessary
02	Ammeter, Voltmeter, Ohm meter, AVO meter, Megger, Test lamp, Clamp on meter, Power factor meter.	As Necessary
03	Lead Acid Battery, Hydrometer	As Necessary
04	Ampere tube, Cotton tap, Leatheroid paper, Insulation varnish.	As Necessary
05	DC motor & DC generator.	As Necessary
06	DC power supply unit.	As Necessary
07	Single phase and Three phase Induction Motor, Alternator.	As Necessary
	Ceiling fan.	

	Single phase Pump motor set.	
08	Synchronous Motor.	As Necessary
O9	Auto Star-Delta starter, Relay, Magnetic contact.	As Necessary
10	Circuit Breaker.	As Necessary
11	Power factor improvement (PFI) unit	As Necessary
12	Solar system.	As Necessary

RECOMMENDED BOOKS:

Sl	Book Name	Writer Name	Publisher Name & Edition
01	Electrical Maintenance I & II.	M. A. Chaudhari	
02	AC and DC Motor winding practical	K. B. Bhatia	
03	Testing Commissioning Operation & Maintenance of Electrical Equipment	S. Rao	
04	Installation Maintenance and Repair of Electrical Machines and Equipment	Madhavi Gupta	
05	Hand Book of Energy Technology, Trends and Perspection	V Daniel Hunt	
06	A test Book of Electrical technology	B L Theraja	

WEBSITE REFERENCES:

Sl	Web Link	Remarks
01	http//www.electricalengineering.org	Search here with topics
02	http//interestingengineering.com	Search here with topics
03	www.google.com	Search here with topics

SUBJECT CODE	SUBJECT NAME	PERIOD PER WEEK		CREDIT
		T	P	C
26754	**Electrical Engineering Project – II**	-	6	2

Rationale	Diploma in engineering level students is required to acquire the knowledge and skills on the area of Electrical Engineering Project – II. It is one of the most important subjects in respect to prepare and make some of the devices, machines and appliances which are much more important for the diploma engineers. Its deals with construct of LED light, rewind of a single-phase motor, Design and construct instant power supply unit, magneto type small generator, solar power system, make a digital voltmeter and extend the range, Assemble and disassemble of indicating type ohm meter and extend the range, assemble of 3D printer, indicating type ohm meter and extend the range, Microcontroller based water level controller, Assemble of 3D-printer. After completion of above mention task and project that will be helpful to be a self-employer and entrepreneur. Such knowledge of the pre-requisite for these fields will help the student for effective discharge of their duties and it has been given more emphasis on practical aspect rather than theory in teaching learning approach.
Learning Out-come (Practical)	**After undergoing the subject, Students will be able to** 1. Design and construct 10w, 15w and 20w LED light 2. Rewind a single-phase motor. 3. Construct an automatic Y-Δ starter. 4. Design and construct instant power supply unit (IPS). 5. Make a magneto type small generator. 6. Construct a solar power system with charge controller). 7. Make a digital voltmeter and extend the range. 8. Disassemble and assemble an indicating type ohm meter and extend the range. 9. Make an electronic water level controller using micro-controller. 10. Assemble 3D-printer

SL No.	Experiment name with procedure	Class (3 period)	Marks (continuous)
1	**Design and construct a 10w, 15w and 20w LED light.** 1.1 Inspect the old LED light / website. 1.2 Collect all spare parts from the market. 1.3 Make a circuit diagram. 1.4 Fixup all spare parts on the PCB. 1.5 Check and test the task. 1.6 Supply power and measure the light watt. 1.7 Maintain the record of performed task.	2	5
2	**Rewind a single-phase motor.** 2.1 Disassemble a single-phase motor. 2.2 Select the winding materials, tools and equipment for winding of motor. 2.3 Draw the winding diagram of motor. 2.4 Remove the existing damage winding and count the number of turns and weight the remove coil. 2.5 Clean and wash the slots by petrol and make a former and winding of coil on former. 2.6 Insert the leatheroid paper into the slot of the stator of the motor and place the coil in the slots of the core and Joint the coil as per winding diagram and put ampere tube in terminals. 2.7 Test the winding for continuity, insulation resistance, short circuit, open circuit, earth or body and also test the centrifugal switch. 2.8 Wrap the coil with cotton tape and apply varnish and bake the coils. 2.9 Assemble the motor and connect power and test the performance of the motor. 2.10 Estimate the cost of rewinding of motor. 2.11 Maintain the record of performed task.	4	5
3	**Construct an automatic Y-Δ starter** 3.1 Follow the catalogue or manuals and literatures. 3.2 Select the size, rating and type of motor starter and materials required for manufacture the starter. 3.3 Draw circuit diagram and working drawing. 3.4 Connect all the parts like as magnetic contactor, timer, push switch excreta on a board.	2	5

	3.5 Connect the starter with motor and connect power supply and observe the performance. 3.6 Estimate the cost of construction of motor starter. 3.7 Analyze the design and construction of the motor starter. 3.8 Maintain the record of performed task.		
4	**Design and construct instant power supply unit (IPS)** 4.1 Follow the different manufacturers' literature or catalogue or manuals. 4.2 Calculate the input and output voltage rating of an instant power supply. 4.3 Draw the CKT diagram. 4.4 identify the materials required for manufacturing IPS. 4.5 Prepare the PCB according to the circuit diagram. 4.6 Insert the components on the PCBS per circuit diagram and solder them. 4.7 Fix up the PCB and other components. 4.8 Check and test IPS. 4.9 Maintain the record of performed task.	4	5
5	**Make a magneto type small generator** 5.1 Collect different type of small generator from cycle, old megar, old vehicle, old magnet from speaker of television, sound box etc. 5.2 Select the type of generator which you want to make. 5.3 Collect old iron core as per requirement. 5.4 Wind the core with proper size super enamel copper wire. 5.5 Collect permanent magnet which is appropriate with the collected core. 5.6 Select a motor for prime mover. 5.7 Fix up all component in a frame and measure the voltage of the generator and connect lighting load. 5.8 Maintain the record of performed task.	2	5
6	**Construct a solar power system with charge controller** 6.1 Follow different manufacturers' literature catalogue or manuals. 6.2 Select the output power of the plant. 6.3 Draw the layout diagram of the solar plant. 6.4 Select the materials required for manufacturing the solar plant. 6.5 Develop the circuit with charge controller. 6.6 Fix up all the components accordingly. 6.7 Estimate the cost of the plant. 6.8 Maintain the record of performed task.	3	5

7	**Make a Digital voltmeter and extend the range.** 7.1 Dissemble an old voltmeter (digital type/website). 7.2 Select the tools materials and equipment of the voltmeter. 7.3 Draw the diagram of the meter. 7.4 Collect Microcontroller and spear parts. 7.5 Connect and solder all spear parts on the PCB. 7.6 Test Voltmeter and it's range. 7.7 Maintain the record of performed task.	3	5
8	**Disassemble and assemble an indicating type ohm meter and extend the range.** 8.1 Dissemble an old ohm meter (indicating type). 8.2 Select the tools materials and equipment of the ohm meter. 8.3 Draw the diagram of the meter. 8.4 Insert and join the materials and equipment of the meter circuit. 8.5 Connect and test ohm meter range. 8.6 Maintain the record of performed task.	2	5
9	**Make an electronic water level controller using micro-controller.** 9.1 Follow the catalogue/ manuals and other related books. 9.2 Design the water level controller circuit using microcontroller. 9.3 Draw the circuit diagram. 9.4 Identify materials required for the construction. 9.5 Sketch the layout plan for the construction of water level controller. 9.6 Connect the controller with motor and float in the water tank. 9.7 Connect the controller with the microcontroller. 9.8 Test the performance of controller. 9.9 Estimate the cost of construction and design. 9.10 Maintain the record of performed task.	4	5

10	**Assemble 3D-printer using micro-controller and Micro-processor.** 10.1 Identify the different component of 3D printer. 10.2 Collect all spares from the market. 10.3 Draw a block diagram of 3D printer. 10.4 Assemble the printer as per block diagram. 10.5 Install required software. 10.6 Test all the connection very carefully. 10.7 Connect the printer with the computer and run the printer. 10.8 Print any 3D object. 10.9 Maintain the record of performed task.	6	5
	Total	**32**	**50**

Reference Books:

1. **Electrical Charge & IPS -Sharma.**
2. **Basic Motor Dynamo Fan – S. Mondal.**
3. **AC and DC Motor Winding Practical – K.B. Bhatia**
4. **Motor Winding with Single Phase and Three Phase Motor Data – S.K. Gupta.**
5. **Basic Practical Knowledge – M.M. Khoibar Ali.**
6. **Hobby Electronics – Debashis Bondopadhay**
7. **Search Google and Youtube.**

Subject Code	Subject Name	Period per Week			Credit
26853	**Microprocessor & Microcontroller**	**T**	**P**	**C**	
		2	**3**	**3**	

Rationale	Diploma in Engineering Level students are required to acquire knowledge and skill on the area of microprocessor and microcontroller with special emphasis on the basic concept of PIC, AVR, procedure of embedded coding and hardware testing, microcontroller and its characteristics, output port characteristics, peripheral module feature, Speed control of DC motor and Industrial control system. Microprocessor & Microcontroller is a subject where the students will deal with the various types of embedded control system are employed in industries. The knowledge of Microprocessor & Microcontroller is the pre-requisites for electrical engineer for effective discharge of their duties in industries. After completion of this course student will have the concept of base project development. Here, more emphasis is given on practical aspect rather than theory in teaching learning approach.
Learning Outcome (Theoretical)	After completing the course student will be able to: • Interpret architecture of 8086 microprocessor. • Describe uses of PIC series microcontroller. • Develop Assembly language program for the PIC mid-range microcontroller. • Develop C language program for the PIC microcontroller. • State the uses of AVR series microcontroller. • Develop C language program for the AVR microcontroller. • State the Utilize I/O port, Timer and Counter, Serial communication of microcontroller. • Prepare Interface with real world devices. • Explain mini development kit.
Learning Outcome (Practical)	After undergoing the subject, students will be able to: 1. Execute program for different MCU. 2. Apply details procedure of microcontroller. 3. Develop application in assembly & C language. 4. Originate and test a program for flashing LEDs by using any MCU. 5. Develop and test a program for displaying 0 to 9 on a 7-Segment display by using any MCU. 6. Drive LCD using any MCU. 7. Operate DC motor using any MCU. 8. Drive any AC load (light, fan etc.) using any MCU. 9. Design and test a program for using built-in timer with any MCU. 10. Use and configure in serial port communication by using any MCU. 11. Interface temperature sensor by using any MCU.

Detailed Syllabus (Theory)

Unit	Topics with contents	Class (1 Period)	Final Marks
1.	**Fundamentals of Microcontroller & Microprocessor** 1.1 Define Microprocessor & Microcontroller. 1.2 Describe the evaluation of 4, 8, 16, 32 and 64-bit microprocessor. 1.3 Compare between Microprocessor and Microcontroller. 1.4 Mention different types of Microcontrollers. 1.5 State the characteristics of different types of microprocessors. 1.6 Describe the block diagram of simple microcomputer & simple microcontroller.	2	4
2	**Intel 8086 microprocessor** 2.1 Describe the features of 8086/8088 microprocessor. 2.2 State the instruction execution sequence of 8086 microprocessor. 2.3 Sketch the architecture of 8086 microprocessor. 2.4 Describe the register structure of 8086 microprocessor.	3	6
3	**Memory interface of the 8086 microprocessors** 3.1 Sketch the 8086-system memory interface. 3.2. State even and odd address boundaries. 3.3. Describe the organization of IBM address space of 8086 microprocessor. 3.4. Explain the generation of physical memory address. 3.5 Relate among logical segment address, offset and physical memory address. 3.5. Describe the hardware organization of the memory address space of 8086. 3.6. Explain the memory read and write bus cycle of 8086 microprocessor.	4	6
4	**Input/output interface and peripheral devices of the 8086 microprocessors** 4.1 Describe the 8086 system I/O interface. 4.2 State the I/O address space of the 8086 system. 4.3 Interpret the I/O read and I/O write bus cycle of 8086 microprocessor. 4.4 Define programmable peripheral devices.	2	3
5	**Features & Architecture of the PIC series** 5.1 State different family/series of PIC microcontroller. 5.2 Mention the purposes of different family/series of PIC MCU. 5.3 Mention the features of different family/series of PIC MCU. 5.4 Describe main blocks of PIC mid-range MCU.	2	3
6	**Assembly Language Programming of PIC Mid-range Microcontroller** 6.1 Describe Assembly language, Assembler, Linker and IDE.	4	8

	6.2 Define Instruction and Instruction set.		
	6.3 Classify instructions.		
	6.4 Mention the fields of an assembly language instruction.		
	6.5 Describe the function of assembly language instruction.		
	6.6 State CPU Instruction & Assembler directives.		
	6.7 Describe the commonly used Assembler directives.		
	6.8 Mention steps to create and execute assembly language program.		
	6.9 Develop a program in assembly language to send data to the output port.		
7	**Programming in C for PIC mid-range MCU**	**2**	**5**
	7.1 Mention the necessity to write a program in C for microcontroller.		
	7.2 List C programming data types and operators.		
	7.3 Describe creating time delay in C programming.		
	7.4 Write the program in C for both accessing port and serial communication.		
8	**Timer/counter**	**2**	**4**
	8.1 List the function of a timer.		
	8.2 Discuss the mode of operation of a timer.		
	8.3 Calculate the initial value of timer for creating a certain delay.		
	8.4 Write C program for creating delay of certain amount of time using Timer.		
	8.5 Describe the Timer as an even counter.		
	8.6 Develop program for generating square wave and PWM using C programming.		
9	**Interrupt of Microcontroller**	**2**	**4**
	9.1 List interrupts of the mid-range PIC MCU.		
	9.2 Define Interrupt service routine (ISR).		
	9.3 Mention the interrupt priority and vector locations.		
	9.4 State the determination procedure of enabling and disabling interrupt.		
	9.5 Mention the steps in executing an interrupt.		
	9.6 Describe External Hardware, Timer and Serial communication Interrupt.		
10	**AVR Series microcontroller**	**3**	**6**
	10.1 Describe the features of AVR series MCU.		
	10.2 Compare between PIC and AVR.		
	10.3 Explain different main blocks of AVR.		
	10.4 Determine the target use of AVR MCU.		
11	**Serial communication in AVR.**	**2**	**4**
	11.1 Mention different types of communication in digital System.		
	11.2 List the common features of serial port in an MCU.		
	11.3 Explain the serial communication protocol and data framing.		
	11.4 Describe the procedure of setting Baud rate of serial port.		
	11.5 Write program to transmit and receive data through serial		

Sl.		Class	Marks

12	**Arduino, Raspberry Pi and other development kit.**	**4**	**7**
	12.1 Define Arduino, Arduino board and Arduino shield.		
	12.2 State the features of Arduino board.		
	12.3 Explain the block diagram of Arduino board.		
	12.4 Illustrate the Pinout Configuration of Arduino Uno		
	12.5 Describe the use of Arduino Board and Sensor.		
	12.6 Write a program to take temperature sensor data or light sensor data using Arduino.		
	12.7 State the feature and uses of Raspberry Pi board.		
	12.8 Mention commonly used mini development kit based on MCU.		
	TOTAL	**32**	**60**

Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
1	**Perform the task to develop and execute an assembly language program for solving arithmetic problems using 8086/88 trainer or Microsoft Macro Assembler(MASM) type tools or software simulator** 1.1 Write down in general terms the algorithm for the task program has to be solved using flow chart 1.2 Write an initialization checklist for the program. 1.3 Determine instruction statement required to each part of the program. 1.4 Start writing assembly language core for the program. 1.5 Execute the program on the microprocessor. 1.6 Prepare a power point presentation to develop and execute an assembly language program for solving arithmetic problems using 8086/88 trainer or MASM type tools or software simulator. 1.7 Maintain the record of performed task.	1	2
2	**Execute the task to develop an assembly language program for solving logical problems using 8086/88 trainer or MASM type tools or software simulator.** 2.1 Perform a bitwise logical AND operation between two operands and store the result in the destination operand. 2.2 Perform a bitwise logical OR operation between two operands and store the result in the destination operand. 2.3 Perform a bitwise logical NOT operation between two operands and store the result in the destination operand. 2.4 Perform a bitwise logical XOR operation between two	1	1

	operands and store the result in the destination operand. 2.5 Perform a bitwise logical XNOR operation between two operands and store the result in the destination operand. 2.6 Prepare a power point presentation to develop an assembly language program for solving logical problems using 8086/88 trainer or MASM type tools or software simulator. Maintain the record of performed task.		
3	**Implement and execute an assembly language program to compute 1's or 2's complement of binary number using 8086/88 trainer or MASM type tools or software simulator.** 3.1. Load the data from a memory location into accumulator (A). 3.2 Complement content of accumulator. 3.3 Store Complement content of accumulator in a memory location. 3.4 Add 01 to accumulator content. 3.5 Store content of accumulator in a memory location. 3.6 Prepare a power point presentation to Implement and execute an assembly language program to compute 1's or 2's complement of binary number using 8086/88 trainer or MASM type tools or software simulator. 3.7 Maintain the record of performed task.	1	1
4	**Perform the task to transmit data from a microprocessor to an I/O using Intel 8086/8088 based microprocessor trainer or MASM type tools or simulator software** . 4.1 Perform MOV (Copy byte or word from specified source to specified destination.) 4.2 Perform PUSH (Copy specified word to top of stack). 4.3 Perform POP (Copy word from top of stack to specified location). 4.4 Copy all registers to stack. 4.5 Perform POPA (Copy words from stack to all resistors). 4.6 Prepare a power point presentation to perform the task to transmit data from a microprocessor to an I/O using Intel 8086/8088 based microprocessor trainer or MASM type tools or simulator software. 4.7 Maintain the record of performed task.	1	1

5	**Develop and test a program for flashing LEDs by using any MCU.**	2	3
	5.1 Design the circuit diagram.		
	5.2 Draw the process flow chart.		
	5.3 Write the program using c programming.		
	5.4 Compile the program.		
	5.5 Simulate the program and the circuit if necessary.		
	5.6 Flash/Download the Hex file/program to the MCU code memory.		
	5.7 Construct the circuit.		
	5.8 Power the circuit and observe the output.		
	5.9 Debug program if necessary.		
	5.10 Prepare a power point presentation to develop and test a program for flashing LEDs by using any MCU.		
	5.11 Maintain the record of performed task.		
6	**Originate and test a program for displaying 0 to 9 on a 7-Segment display by using any MCU.**	1	2
	6.1 Design the circuit diagram.		
	6.2 Draw the process flow chart.		
	6.3 Write the program.		
	6.4 Compile the program.		
	6.5 Simulate the program and the circuit if necessary		
	6.6 Flash/Download the Hex file/program to the MCU code memory.		
	6.7 Construct the circuit.		
	6.8 Power the circuit and observe the output.		
	6.9 Debug program if necessary.		
	6.10 Prepare a power point presentation to 0riginate and test a program for displaying 0 to 9 on a 7-Segment display by using any MCU.		
	6.11 Maintain the record of performed task.		
7	**Develop and test a program for Interfacing LCD by using any MCU.**	1	2
	7.1 Design the circuit diagram.		
	7.2 Draw the process flow chart.		
	7.3 Write the program.		
	7.4 Compile the program.		
	7.5 Simulate the program and the circuit if necessary.		
	7.6 Flash/Download the Hex file/program to the MCU code memory.		
	7.7 Construct the circuit.		
	7.8 Power the circuit and observe the output.		
	7.9 Debug program if necessary.		
	7.10 Prepare a power point presentation to Develop and test a program for Interfacing LCD by using any MCU.		
	7.11 Maintain the record of performed task.		

8	**Develop and test a program for Interfacing DC motor by using any MCU.**	1	2
	8.1 Design the circuit diagram.		
	8.2 Draw the process flow chart.		
	8.3 Write the program.		
	8.4 Compile the program.		
	8.5 Simulate the program and the circuit if necessary.		
	8.6 Flash/Download the Hex file/program to the MCU code memory.		
	8.7 Construct the circuit.		
	8.8 Power the circuit and observe the output.		
	8.9 Debug program if necessary.		
	8.10 Prepare a power point presentation to develop and test a program for Interfacing DC motor by using any MCU.		
	8.11 Maintain the record of performed task.		
9	**Develop and test a program for Interfacing any AC load (light, fan etc.) by using any MCU.**	2	3
	9.1 Design the circuit diagram.		
	9.2 Draw the process flow chart.		
	9.3 Write the program.		
	9.4 Compile the program.		
	9.5 Simulate the program and the circuit if necessary.		
	9.6 Flash/Download the Hex file/program to the MCU code memory.		
	9.7 Construct the circuit.		
	9.8 Power the circuit and observe the output.		
	9.9 Debug program if necessary.		
	9.10 Prepare a power point presentation to develop and test a program for interfacing any AC load (light, fan etc.) by using any MCU.		
	9.11 Maintain the record of performed task.		
10	**Develop and test a program for built-in timer using any MCU.**	1	2
	10.1 Design the circuit diagram.		
	10.2 Draw the process flow chart.		
	10.3 Write the program.		
	10.4 Compile the program.		
	10.5 Simulate the program and the circuit if necessary.		
	10.6 Flash/Download the Hex file/program to the MCU code memory.		
	10.7 Construct the circuit.		
	10.8 Power the circuit and observe the output.		
	10.9 Debug program if necessary.		
	10.10 Prepare a power point presentation to develop and test a program for built-in timer using any MCU.		

	10.11 Maintain the record of performed task.			
11	**Develop and test a program for interfacing temperature sensor by using Arduino kit.** 11.1 Design the circuit diagram. 11.2 Write the program. 11.3 Compile the program. 11.4 Flash/Download the Hex file/program to the MCU code memory. 11.5 Construct the circuit. 11.6 Power the circuit and observe the output. 11.7 Prepare a power point presentation to develop and test a program for interfacing temperature sensor by using Arduino kit. 11.8 Maintain the record of performed task.		2	3
12	**Develop and test a program for driving an AC load by using Arduino kit with any wireless shield.** 12.1 Design the circuit diagram. 12.2 Write the program. 12.3 Compile the program. 12.4 Flash/Download the Hex file/program to the MCU code memory. 12.5 Construct the circuit. 12.6 Power the circuit and observe the output. 12.7 Prepare a power point presentation to develop and test a program for driving an AC load by using Arduino kit with any wireless shield. 12.8 Maintain the record of performed task.		2	3

	NB:
	  i. For the experiments of microcontroller (MCU) students can use any MCU i.e., PIC series, AVR, 8051 family etc.
	  ii. For developing program, students can use any development tools i.e., MPLAB X, Atmel studio etc.			

	Total		**16**	**25**

Necessary Resources (Tools, Materials, equipment's and Machineries):

Sl	Item Name	Quantity
01	MCU training kit	5
02	Program/software development tools for MCU	5
03	Microprocessor training kit/ simulator software	5
04	Computer	5
05	Arduino board, shield with sensor set	5

Sl	Book Name	Writer Name	Publisher Name & Edition
01	Microprocessors and Microcomputer-Based System Design	Mohamed Rafiquzzaman	CRC Press
02	The Intel Microprocessors	Brey, Barry B	Pearson Prentice Hall
03	Microprocessor and Interfacing	Douglas V. Hall	Pearson
04	PIC Microcontroller and Embedded system	Muhammad Ali Mazidi	Pearson
05	C Programming for the PIC Microcontroller	Hubert Henry Ward	Apress

Website References:

Sl	Weblink	Remarks
01	www.microchip.com	
02	www.mikroe.com	