



BANGLADESH TECHNICAL EDUCATION BOARD

Agargaon, Sher-E-Bangla Nagar

Dhaka-1207.

**04-YEAR DIPLOMA IN ENGINEERING CURRICULUM
COURSE STRUCTURE & SYLLABUS
(PROBIDHAN-2022)**

ELECTRICAL TECHNOLOGY

TECHNOLOGY CODE: 67

4TH SEMESTER

(Effective from 2022-2023 Academic Sessions)

DIPLOMA IN ENGINEERING CURRICULUM

COURSE STRUCTURE

(PROBIDHAN-2022)

TECHNOLOGY NAME: ELECTRICAL TECHNOLOGY (67)

(4TH 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	25811	Social Science	2	-	2	40	60	100	-	-	-	100
2	25841	Accounting	2	-	2	40	60	100	-	-	-	100
3	26741	Electrical Installation, Planning and Estimating	3	3	4	60	90	150	25	25	50	200
4	26742	DC Machine	3	3	4	60	90	150	25	25	50	200
5	26743	Electrical Engineering Project-I	-	6	2	-	-	-	50	50	100	100
6	26845	Digital Electronics	3	3	4	60	90	150	25	25	50	200
7	27044	Applied Mechanics	2	3	3	40	60	100	25	25	50	150
Total			15	18	21	300	450	750	150	150	300	1050
Total Period			33									
Theory: Practical (%)			45.5%	54.5%								

Subject Code	Subject Name	Period per Week		Credit
		T	P	
25811	SOCIAL SCIENCE	2	0	2

Rationale	<p>Social science deals with the social, political, economic, cultural, ethical and historical aspects of society. All these aspects help to develop different subjects of social sciences- sociology, civics, political science, economics, ethics, history etc. Students can gather social skills through acquiring knowledge of these social sciences. Social science covers only such topics which will inspire diploma graduates to become good citizen and will enable them to associate an individual with other individuals in a society or workplace. The diploma graduates can gather knowledge of the basic concepts of social sciences, human endeavor in the economic system, the realities of Bangladesh economy, fundamental rights, contemporary social changes, historical background and socio-economic culture of Bangladesh. Social science helps to explain how society works, study of social science makes students an efficient citizen in a democracy. It is essential for communities and organization.</p>
Learning Outcome (Theoretical)	<p>After undergoing the subject, students will be able to:</p> <ul style="list-style-type: none"> • Discuss the importance of social sciences and relationship among social sciences • Define the basic concepts of social sciences. • Describe the rights and duties of a citizen and qualities a good citizen. • Describe state, government, law and good governance • Explain the realities of Bangladesh economy and the current problems confronting the country • Describe the role of a Diploma Engineers in economic development of Bangladesh • Explain the process of socialization, the agencies of social control and contemporary social changes in Bangladesh • Explore our motherland and its historical background in terms of liberation war • Describe the independence of Bangladesh achieved through the leadership of Bangabandhu Sheikh Mujibur Rahman • Describe culture and civilization of Bangladesh & different ethnic groups in Bangladesh • Explain the United Nations (UN) and its role in maintaining world peace.

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	<p>BASIC CONCEPTS OF SOCIAL SCIENCES</p> <p>1.1. Define social science. 1.2. Explain the importance of social sciences. 1.3. Describe the relationship among Civics, Economics, Political Science, Sociology and Ethics. 1.4. Define society, socialization, nation, nationality, citizen, citizenship and Constitution. 1.5. Define commodity, utility, value, price, wealth, consumption, income, savings, investment, wages and salary.</p>	03	05
2.	<p>SOCIETY AND CITIZENSHIP</p> <p>2.1 Describe the evolutionary stages of society in sociological perspectives. 2.2 State the characteristics of society. 2.3 Describe the rights and duties of a citizen. 2.4 State the qualities of good citizen.</p>	02	04
3.	<p>STATE, GOVERNMENT, LAW AND GOOD GOVERNANCE</p> <p>3.1 Define state, government, law and good governance 3.2 Mention the elements of state. 3.3 Discuss the forms of government. 3.4 Mention the main organs of government. 3.5 Describe the functions of legislature. 3.6 Describe the functions of executive. 3.7 Describe the functions of judiciary. 3.8 Discuss the sources of law. 3.9 Discuss the role of government to establish good governance.</p>	04	08
4.	<p>SOCIALIZATION, SOCIAL CONTROL AND SOCIAL CHANGE</p> <p>4.1 Define socialization, social control and social change. 4.2 Describe the agencies of socialization. 4.3 Describe the agencies of social control. 4.4 Explain the contemporary social changes in Bangladesh.</p>	03	05

	<p>4.5 Discuss the role of information and communication technology for social changes in Bangladesh.</p> <p>4.6 Discuss the impact of social changes.</p>		
5.	<p>DEMAND, SUPPLY, UTILITY AND NATIONAL INCOME</p> <p>5.1 Define demand.</p> <p>5.2 Define supply.</p> <p>5.3 Explain the law of demand and supply.</p> <p>5.4 Draw the demand and supply curve.</p> <p>5.5 Explain the law of diminishing marginal utility.</p> <p>5.6 Define national income.</p> <p>5.7 Discuss GDP, GNP and NNP.</p> <p>5.8 State the methods of measuring national income.</p>	04	08
6.	<p>ECONOMIC AND SUSTAINABLE DEVELOPMENT OF BANGLADESH</p> <p>6.1 Define rural and urban economy.</p> <p>6.2 Mention major problems of rural and urban economy.</p> <p>6.3 Explain the reasons of migration of rural population to urban areas.</p> <p>6.4 Discuss the role of Diploma graduate in the overall socio-economic development in Bangladesh.</p> <p>6.5 Describe the importance and potential uses of natural resources for sustainable development.</p>	04	08
7.	<p>THE PARTITION OF INDIA AND THE SUBSEQUENT POLITICAL EVENTS AND THE EMERGENCE OF INDEPENDENT-SOVEREIGN BANGLADESH</p> <p>7.1 Describe Language Movement and contemporary political and social events.</p> <p>7.2 State the 6-point demands, the Agartala Conspiracy Case and the Mass Uprising in 1969.</p> <p>7.3 Discuss the Election of 1970 and aftermath.</p> <p>7.4 The Historic Liberation War in 1971 and the emergence of sovereign Bangladesh.</p> <p>7.5 Discuss the reconstruction activities of independent-sovereign Bangladesh.</p> <p>7.6 State the background of formulating the constitution of Bangladesh.</p> <p>7.7 State the salient features of Bangladesh constitution.</p>	04	08

	7.8 Discuss the fundamental rights of a citizen in the context of Bangladesh constitution. 7.9 Difference between human rights and fundamental rights.		
8.	THE BANGABANDHU AND BANGLADESH 8.1 State the biography of Bangabandhu Sheikh Mujibur Rahman. 8.2 State the historic speech of 7 March, 1971. 8.3 Describe the significance of historic speech of 7 March for independence of Bangladesh. 8.4 Describe the role of Bangabandhu Sheikh Mujibur Rahman for achieving independence of Bangladesh. 8.5 Discuss the mournful 15 August, 1975.	03	05
9.	CULTURE AND CIVILIZATION OF BANGLADESH & DIFFERENT ETHNIC GROUPS IN BANGLADESH 9.1 Define culture and civilization. 9.2 State the elements of culture and cultural lag. 9.3 Define ethnic group. 9.4 Discuss the social and cultural lifestyle of Garo, Chakma, Rakhain and Santhal. 9.5 Describe the role of archeological relics- Mahasthangarh, Paharpur and Mainamati in the socio-cultural development of Bangladesh.	03	05
10.	THE UNITED NATIONS (UN) AND WORLD PEACE 10.1 State the main organs of United Nations. 10.2 State the functions of General Assembly. 10.3 State the functions of Security Council. 10.4 State the specialized agencies of United Nations. 10.5 Discuss the role of United Nations. 10.6 Discuss the role of Bangladesh in the United Nations.	02	04
	Total	32	60

Recommended Books:

Sl	Book Name	Writer Name	Publisher Name & Edition
০১	পৌরনীতি	মোজাম্মেল হক	হাসান বুক হাউস
০২	রাষ্ট্রবিজ্ঞানের কথা	ড. এমাজউদ্দীন আহমদ	বাংলাদেশ বুক করপোরেশন লি.
০৩	সমাজবিজ্ঞান পরিচিতি	ড. মুহাম্মদ হাবিবুর রহমান	হাসান বুক হাউস
০৪	সমাজবিজ্ঞান সমীক্ষণ	ড. নাজমুল করিম	নওরোজ কিতাবিস্তান

০৫	অর্থনীতি	আনিসুর রহমান	অ্যাডর্ন পাবলিকেশনস
০৬	অর্থনীতি	মাসুম আলী	আইডিয়াল বুকস
০৭	বাংলাদেশের ইতিহাস	কে. আলী	আজিজিয়া বুক ডিপো
০৮	'Mahasthangarh', 'Paharpur', 'Mainamati'	Banglapedia	Bangladesh Asiatic Society
০৯	বাংলাদেশের ইতিহাস ১৯৪৭-১৯৭১	ড. মো: মাহবুবর রহমান	সময় প্রকাশন
১০	বাংলাদেশের অভ্যুদয়	আবুল মাল আবদুল মুহিত	সময় প্রকাশন
১১	ইতিহাস: সমাজ ও সংস্কৃতি ভাবনা	মুসা আনসারী	বাংলা একাডেমি, ঢাকা
১২	অসমাপ্ত আত্মজীবনী	শেখ মুজিবুর রহমান	দি ইউনিভার্সিটি প্রেস লি.
১৩	কারাগারের রোজনামাচা	শেখ মুজিবুর রহমান	দি ইউনিভার্সিটি প্রেস লি.

Subject code	Subject Name	Period per week		Credit
25841	Accounting	T	P	C
		2	0	2

Rationale	All diploma graduate will work in any insttution or organization or will be an employer this subject knowledgable skill and attitude will health the studies to make appropriate decision for their professional life. This subject will cover the topics like informationtechnology, Evaluation of an organization, journal entry system,cash book analysisand Income Tax.
Learning Outcome (Theoretical)	<p>After undergoing the subject, student will be able to:</p> <ul style="list-style-type: none"> ▪ Describe accounting concept ▪ Describe transaction analysis ▪ Describe accounting entry system. ▪ Explain the accounts of debit and credit ▪ Interpret the journal entry system. ▪ Evalute the balance of ledger. ▪ Describe the cash book analysis. ▪ Evaluate of trial balance ▪ Expain the financial statement ▪ Describe income tax assesment.

Detailed Syllabus (Theory)

Unit	Topics with contents	Class (1 Period)	Final Marks
1.	CONCEPT OF ACCOUNTING 1.1 Define accounting. 1.2 State the objectives of accounting. 1.3 State the advantages of accounting. 1.4 State the necessity and scope of accounting.	2	3
2.	TRANSACTION ANALYSIS 2.1 Define transaction. 2.2 Define business transaction. 2.3 Describe the Characteristics of Transaction. 2.4 Discuss the different types of Transaction.	2	3
3.	ENTRY SYSTEM OF ACCOUNTING 3.1 Define single and double entry system. 3.2 Discuss the principles of double entry system. 3.3 Justify whether double entry system is an improvement over the single-entry system. 3.4 Distinguish between single entry and double entry system of accounting	1	3
4.	CONCEPT OF ACCOUNTS 4.1 Define accounts. 4.2 State the objectives of accounts. 4.3 Illustrate different type of accounts. 4.4 State the golden rules of accounting. 4.5 State the rules for debit and credit in each class of accounts. 4.6 Define accounting cycle.	2	3
5.	JOURNAL ENTRY SYSTEM 5.1 Define journal. 5.2 State the objective of journal. 5.3 Mention the various names of journal. 5.4 Prepare the form of journal entry system. 5.5 Solve the problem related journal entry system.	4	10
6.	LEDGER 6.1 Define ledger 6.2 Interpret the form of ledger 6.3 Distinguish between journal and ledger 6.4 Explain "ledger is called the king of all books of accounts" 6.5 Prepare ledger from given transaction	2	3
7.	CASH BOOK ANALYSIS 7.1 Define cash book. 7.2 Classify cash book. 7.3 Explain cash book as both journal and ledger. 7.4 Explain the different types of discount. 7.5 Prepare different types of cash books from given transactions showing balances.	4	10
8.	TRIAL BALANCE ANALYSIS 8.1 Define trial balance. 8.2 State the objective of a trial balance. 8.3 Mention the reasons for non-agreement of trial balance. 8.4 Prepare trial balance from given balance.	3	3
9.	FINAL ACCOUNTS	10	20

	9.1 State the components of final accounts 9.2 Distinguish between trial balance and balance sheet 9.4 List the items to be posted in the trading account profit and loss account and the balance sheet 9.5 Prepare trading account profit and loss account and balance sheet from the given trial balance and other information		
10.	INCOME TAX 10.1 Define income tax. 10.2 State the objective of income tax. 10.3 Classify of assesses. 10.4 State the Taxable income of assesses. 10.5 Describe the Tax rebate. 10.6 Describe ther Income tax year, assessment year and National Board of Revenue (NBR).	2	2
	Total	32	60

REFERENCE BOOKS

SL	Book Name	Writer Name
1.	Book-Keeping & Accounting	Prof. Gazi Abdus Salam
2.	Principles of Accounting	Hafiz uddin
3.	Cost Accounting	Prof. Asimuddin Mondol
4.	হিসাবরক্ষন ও হিসাববিজ্ঞান	পরেশ মন্ডল
5.	উচ্চ মাধ্যমিক হিসাববিজ্ঞান	হক ও হোসাইন
6.	আয়কর	ওয়ালীউল্লাহ

Subject Code	Subject Name	Period per Week		Credit
26741	ELECTRICAL INSTALLATION, PLANNING AND ESTIMATING	T	P	C
		2	6	4

Rationale	<p>Diploma in Engineering Level students are required to acquire the knowledge and skill on the area of Electrical Installation, Planning and Estimating with special emphasis on factors and types of planning and estimating, measurement books, illumination and lighting scheme, types of electrical load, load calculation, current carrying capacity, size of conductor, Internal electrical wiring, service connection, estimate of earthing, motor connections, estimate of LT distribution line, electricity Acts and Rules and utility of electrical codes. Electrical Installation, planning and estimating is a subject where a student will deal various type of estimating which are employed in Industries, Domestic and commercial installations, different types of departments related in electrical work. As such the knowledge of the pre-requisite for these fields for effective discharge of their duties. These necessities the introduction of Electrical Engineering subject in the curriculum of Diploma in Engineering level by the completion of this course student will be able to perform measuring lumen, load calculation, find the conductor size, different types of electrical house wiring, estimate the electrical installation of building, service connection & its estimate, motor connection and estimate of electrification of workshop, estimate of rewinding of motor, earthing, indoor substation, LT distribution line and different types of testing. Have been given more emphasis on practical aspect rather than theory in teaching learning approach.</p>
Learning Outcome (Theoretical)	<p>After Completing the subject, students will be able to:</p> <ul style="list-style-type: none"> ▪ Concept of electrical Installation, planning and estimating ▪ Perceive Measurement books and its utility ▪ Recognize Illumination and Lighting scheme ▪ Generalize Load calculation and conductor size ▪ Interpret Internal electrical wiring ▪ Estimate the electrical installation of buildings ▪ Point out Service connections ▪ Illustrate Motor connection and estimate of electrification of workshop ▪ Estimate of earthing, Indoor substation and LT Distribution line ▪ Conclude Acts, Rules and Electrical code
Learning Outcome (Practical)	<p>After undergoing the subject, students will be able to:</p> <ul style="list-style-type: none"> ▪ Measure lumen ▪ Calculate load ▪ Find the conductor size ▪ Perform different types of electrical house wiring ▪ Estimate the electrical installation of building ▪ Perform service connection and its estimate ▪ Perform Motor connection and estimate of electrification of workshop ▪ Estimate of rewinding of motor, earthing, indoor substation and LT distribution line ▪ Perform different types of testing

Detailed Syllabus (Theory)

Unit	Topics with contents	Period	Marks
1.	<p>ELECTRICAL INSTALLATION ITS PLANNING AND ESTIMATING</p> <p>1.1 Explain electrical installation and types of electrical installation.</p> <p>1.2 Define indoor and outdoor electrical installation.</p> <p>1.3 Distinguish between indoor and outdoor electrical installation.</p> <p>1.4 Describe Planning and the necessity of planning of an electrical installation.</p> <p>1.5 List the main categories of planning of an electrical installation.</p> <p>1.6 Mention the considering factors for proper planning.</p> <p>1.7 Explain Estimating and the necessity of estimating.</p> <p>1.8 List the important steps for costing of an installation.</p> <p>1.9 Mention the considering steps for preparing an estimate.</p>	2	4
2.	<p>MEASUREMENT BOOKS, PRICE SHEET AND SCHEDULE OF LABOR RATES</p> <p>2.1 Describe Measurement Books.</p> <p>2.2 Explain the necessity of MB.</p> <p>2.3 Interpret the styles of maintaining an MB.</p> <p>2.4 Mention proper specifications for the required materials form catalogue.</p> <p>2.5 Describe price sheet and schedule of labor rates.</p> <p>2.6 Explain the necessity of price sheet and labor rates for an estimate.</p> <p>2.7 Prepare a price sheet and a labor rate schedule.</p>	2	4
3.	<p>ILLUMINATION AND LIGHTING SCHEME</p> <p>3.1 Define illumination.</p> <p>3.2 Define Solid angle, Candela, Luminous flux, Luminous intensity, MSCP and MHSCP with different related factors</p> <p>3.3 Explain the laws of illumination.</p> <p>3.4 Calculate illumination required for different purposes.</p> <p>3.5 Prepare a chart of illumination for different lamp system (including CFL, Incandescent and Florescent)</p> <p>3.6 Discuss direct lighting, indirect lighting, semi-direct and semi-indirect lighting.</p> <p>3.7 Describe the level of illumination required for different purposes.</p> <p>3.8 Explain the considering factors for designing a lighting scheme.</p> <p>3.9 Design a lighting scheme.</p> <p>3.10 Solve problems related to illumination and Lighting Scheme.</p>	4	8

4.	<p>ELECTRICAL LOAD, CURRENT CARRYING CAPACITY AND SIZE OF CONDUCTOR</p> <p>4.1 Define electrical load.</p> <p>4.2 Mention the types of electrical load.</p> <p>4.3 Calculate the electrical load of residential building, Academic building, Student hostel, An office building, load of different types of lift and 20 stored building.</p> <p>4.4 Describe the considering factors for determining the conductor size.</p> <p>4.5 Calculate the current carrying capacity of a given circuit and sub circuits.</p> <p>4.6 Calculate Voltage and Voltage drop of conductor</p> <p>4.7 Explain the meaning and utility of RM, RE, SE, SM and SWG.</p> <p>4.8 Find the conductor size from the table.</p>	3	6
5.	<p>INTERNAL ELECTRICAL WIRING.</p> <p>5.1 Explain internal electrical wiring installation.</p> <p>5.2 Describe the main types of internal wiring.</p> <p>5.3 Sketch the layout plan for channel, surface conduit, and concealed conduit of small building.</p> <p>5.4 Prepare schedule of materials for channel, surface conduit, and concealed conduit wiring.</p> <p>5.5 Calculate the load of main circuit and sub circuits.</p> <p>5.6 Select the sizes of wire, main switch, sub-main switches and switches.</p> <p>5.7 Prepare a detail estimate of necessary materials and labor for installation of internal wiring.</p> <p>5.8 Describe the tests to be carried out after completion of wiring of a building.</p>	5	8
6.	<p>SERVICE CONNECTIONS</p> <p>6.1 Explain service main.</p> <p>6.2 Sketch the layout of 1-phase service connection required energy meter, DB & SDB.</p> <p>6.3 Prepare a schedule of materials for single phase service main.</p> <p>6.4 Generate a detail estimate of materials & Labor for 1-phase service connection.</p> <p>6.5 Sketch the layout of 3-phase service connection required energy meter, DB & SDB.</p> <p>6.6 Prepare a schedule of materials for 3-phase service connection.</p> <p>6.7 Produce a detail estimate for materials & Labor of 3-phase service connection.</p>	3	6
7.	<p>ESTIMATE OF EARTHING</p> <p>7.1 Prepare a schedule of necessary materials for Pipe earthing,</p>	5	8

	<p>Plate earthing, Rod earthing, and Sheet earthing.</p> <p>7.2 Produce an Estimate for each type of Earthing.</p> <p>7.3 Produce an Estimate for earthing for 5-storied building.</p> <p>7.4 Prepare an Estimate for earthing for 10-storied building.</p> <p>7.5 Generate an estimate for earthing for 20-storied building</p> <p>7.6 Explain the method of testing of an earthing installation.</p> <p>7.7 List the desired value of earth resistance for different installations.</p>		
8.	<p>ESTIMATE OF INDUSTRIAL ELECTRICAL INSTALLATION</p> <p>8.1 Sketch the layout plan and single line wiring diagram of a motor connection</p> <p>8.2 Mention the position and calculate the distance of motor, main switch, starter and accessories in the diagram</p> <p>8.3 Find out the sizes of wire, main switch and starter for the installation.</p> <p>8.4 Prepare an estimate for a motor connection</p> <p>8.5 Sketch the layout plan for casing wiring of a small workshop showing lighting loads and power loads</p> <p>8.6 Sketch the layout plan for surface conduit wiring of a small workshop showing lighting loads and power loads</p> <p>8.7 Calculate power loads and lighting loads respective sub-circuits and main circuit</p> <p>8.8 Select the sizes of wires, switches, sub-main switches, main switch and distribution boards to lighting and power line respectively.</p> <p>8.9 Prepare an estimate for the required materials and labor from the schedule.</p>	4	6
9.	<p>ESTIMATE OF LT OVERHEAD DISTRIBUTION LINE.</p> <p>9.1 Sketch the layout plan of a 400V, 3-phase 4-wire overhead distribution line with street poles, conductors, insulators and other accessories.</p> <p>9.2 Sketch the layout plan of a 400V, 3-phase 4-wire overhead distribution line with street poles, conductors, insulators and other accessories by E-CAD.</p> <p>9.3 Prepare a schedule of materials required for overhead line.</p> <p>9.4 Generate an estimate for required materials for one-kilometer-long overhead LT distribution line with the 5th wire for street lighting.</p> <p>9.5 Prepare a schedule of labor for overhead LT distribution line.</p> <p>9.6 Make an estimate for overhead LT distribution line.</p>	2	6
10.	<p>ELECTRICITY ACT, RULES AND UTILITY OF ELECTRICAL CODES.</p> <p>10.1 List the main electricity rules of Bangladesh Electricity Act.</p> <p>10.2 Describe the importance of electricity Act and Rules.</p> <p>10.3 Explain the need for maintaining safety procedure against electrical</p>	2	4

	<p>hazards.</p> <p>10.4 Describe the safety measures.</p> <p>10.5 List the electrical codes of Bangladesh National Building Code and (BNBC) and International Building code.</p> <p>10.6 Explain different electrical codes of National Building Code and International Building code</p> <p>10.7 State the advantages of using the electrical codes.</p>		
	Total	32	60

Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
1	<p>MEASURE THE ILLUMINATION LEVEL OF A SURFACE.</p> <p>1.1 Collect necessary tools, equipment and materials.</p> <p>1.2 Prepare a job for measuring Illumination.</p> <p>1.3 Operate the lumen meter.</p> <p>1.4 Measure the illumination level in your wiring lab/ class room.</p> <p>1.5 Compare the obtained reading with the calculated value.</p> <p>1.6 Maintain the record of performed task.</p>	1	2
2	<p>PLAN AND ESTIMATE FOR ELECTRIFICATION OF A CLASS ROOM.</p> <p>2.1 Sketch the layout plan and single line wiring diagram of a class room.</p> <p>2.2 Draw the wiring and circuit diagram.</p> <p>2.3 Sketch the wiring and circuit diagram by E-CAD.</p> <p>2.4 Indicate the positions of electrical fittings in the plan.</p> <p>2.5 Select wires and main switch from the calculated load of main circuit and sub-circuits.</p> <p>2.6 Measure the distances of fittings from the main board & SDB and find out the length of the wire.</p> <p>2.7 List the materials in the schedule and find out the cost.</p> <p>2.8 Add labor charges from the schedule with material cost for the summary of estimate.</p> <p>2.9 Maintain the record of performed task.</p>	1	2
3	<p>DETERMINE CABLE SIZE FROM CABLE CATALOGUE.</p> <p>3.1 Collect necessary tools, equipment and materials.</p> <p>3.2 Calculate the load of main circuits and sub-circuits of different installations.</p> <p>3.3 Find out the corresponding suitable cable size from the catalogue allowing safety factor.</p>	1	2

	<p>3.4 Check the size of the cables by using SWG.</p> <p>3.5 Find out the size of the cables in respect of RM & RE.</p> <p>3.6 Maintain the record of performed task.</p>		
4	<p>PERFORM CHANNEL WIRING.</p> <p>4.1 Sketch the layout plan mentioning positions of fittings.</p> <p>4.2 Draw the wiring and circuit diagrams.</p> <p>4.3 Select the necessary size of wires, main switch, fuse/MCB.</p> <p>4.4 Measure the distance of the fittings from the main switch.</p> <p>4.5 Mark the position of the fittings.</p> <p>4.6 Fix up the rowel plugs, boards and casing on the wall.</p> <p>4.7 Set wires, switches and outlets.</p> <p>4.8 Install energy meter, cut-out/MCB and main switch.</p> <p>4.9 Prepare estimate of Channel wiring.</p> <p>4.10 Maintain the record of performed task.</p>	3	4
5	<p>PERFORM SURFACE CONDUIT WIRING.</p> <p>5.1 Sketch the layout plan mentioning positions of fittings.</p> <p>5.2 Sketch the wiring and circuit diagrams.</p> <p>5.3 Select wires, main switch, fuse/MCB.</p> <p>5.4 Measure the distance of the fittings from the main switch.</p> <p>5.5 Mark the position of the fittings.</p> <p>5.6 Fix up the rowel plugs, boards and casing on the wall.</p> <p>5.7 Set wires, switches and outlets.</p> <p>5.8 Install energy meter, cut-out MCB and main switch.</p> <p>5.9 Prepare estimate of surface conduit wiring.</p> <p>5.10 Maintain the record of performed task.</p>	3	4
6	<p>PERFORM CONCEALED CONDUIT WIRING.</p> <p>6.1 Sketch the layout plan mentioning positions of fittings.</p> <p>6.2 Draw the wiring and circuit diagrams.</p> <p>6.3 Select wires, main switch, fuse/MCB.</p> <p>6.4 Measure the distance of the fittings from the main switch.</p> <p>6.5 Mark the position of the fittings.</p> <p>6.6 Insert conduit into the wall channel and draw wires.</p> <p>6.7 Set wires, switches and outlets.</p> <p>6.8 Install energy meter, cut-out MCB and main switch.</p> <p>6.9 Prepare estimate of concealed conduit wiring.</p> <p>6.10 Maintain the record of performed task.</p>	3	4
7	<p>PLAN AND ESTIMATE FOR ELECTRIFICATION OF A SINGLE STORIED RESIDENTIAL BUILDING.</p> <p>7.1 Sketch the layout plan of a single storied residential building of about 1250 square feet plinth area in a five decimal land with</p>	2	3

	<p>boundary wall and gate showing the position of electric pole for service connection.</p> <p>7.2 Draw the wiring and circuit diagrams and show the service connection.</p> <p>7.3 Sketch the wiring and circuit diagrams and show the service connection by E-CAD.</p> <p>7.4 Show the positions of electrical fittings in the plan.</p> <p>7.5 Select wire, main switch, SDB, fuse or MCB from the calculated load of circuit and sub circuit.</p> <p>7.6 Measure the distance of the fittings from the board to find out the length of wires.</p> <p>7.7 Prepare the estimate for electrification of the building.</p> <p>7.8 Maintain the record of performed task.</p>		
8	<p>PLAN AND ESTIMATE FOR ELECTRIFICATION OF A MULTISTORIED BUILDING.</p> <p>8.1 Sketch the elevation and floor plan of the building.</p> <p>8.2 Draw the wiring and circuit diagrams of a flat.</p> <p>8.3 Show the positions of the fittings in a flat.</p> <p>8.4 Sketch the wiring and circuit diagrams of a flat by E_CAD.</p> <p>8.5 Select wires, main switch, fuse or MCB.</p> <p>8.6 Measure the distance of the fittings from the board to find out the length of wire.</p> <p>8.7 Identify the rising main and power distribution system.</p> <p>8.8 Prepare the estimate for electrification of the building.</p> <p>8.9 Maintain the record of performed task.</p>	2	2
9	<p>INSTALL A SINGLE-PHASE SERVICE CONNECTION.</p> <p>9.1 Sketch the layout plan showing single line service connection from the nearest pole to the service entrance of the building.</p> <p>9.2 Determine the total electrical load of the installation.</p> <p>9.3 Measure the distance from the meter at premises to the nearest electric pole.</p> <p>9.4 Prepare the estimate of material cost, labor cost and contingencies.</p> <p>9.5 Fix up brackets, service pipe and insulators.</p> <p>9.6 Lay two GI guard wires with carlings (use draw vice).</p> <p>9.7 Draw the single core PVC wires through the pipe up to the meter inside the premises.</p> <p>9.8 Connect one aerial fuse with the phase.</p> <p>9.9 Maintain the record of performed task.</p>	1	2
10	<p>INSTALL A THREE-PHASE SERVICE CONNECTION.</p> <p>10.1 Sketch the layout plan showing single line service</p>	1	2

	<p>connection from the nearest pole to the service entrance of the building.</p> <p>10.2 Calculate the total electrical load of the installation.</p> <p>10.3 Measure the distance from the meter at premises to the nearest electric pole.</p> <p>10.4 Prepare the estimate of material, labor cost and contingencies.</p> <p>10.5 Fix up brackets, service pipe and insulators.</p> <p>10.6 Lay two GI guard wires with carlings (use draw vice).</p> <p>10.7 Draw the single core PVC wires through the pipe up to the meter inside the premises.</p> <p>10.8 Connect one aerial fuse with the phase.</p> <p>10.9 Maintain the record of performed task.</p>		
11	<p>PERFORM THE THREE PHASE MOTOR CONNECTION.</p> <p>11.1 Sketch the layout plan and single line wiring diagram of the motor connection.</p> <p>11.2 Sketch the wiring and circuit diagrams by E-CAD.</p> <p>11.3 Indicate the position of the motor, main switch and starter.</p> <p>11.4 Measure the distance of the motor, starter and main switch from the supply main.</p> <p>11.5 Select sizes of wires, main switch and starter.</p> <p>11.6 Prepare Estimate for motor connection considering material cost, labor charges and contingencies.</p> <p>11.7 Following electricity rules connect the supply mains and operate the motor.</p> <p>11.8 Maintain the record of performed task.</p>	1	2
12	<p>PLAN AND ESTIMATE FOR ELECTRIFICATION OF AN ELECTRICAL MACHINE SHOP.</p> <p>12.1 Sketch the layout plan and single line wiring diagram of the shop.</p> <p>12.2 Draw the wiring and circuit diagrams.</p> <p>12.3 Sketch the wiring and circuit diagrams by E-CAD.</p> <p>12.4 Indicate the positions of the fittings in the plan.</p> <p>12.5 Select wires, main switch, fuse or MCB.</p> <p>12.6 Measure the distance of the fittings from the board to find out the length of wire.</p> <p>12.7 List the materials in the schedule of materials and find out the cost.</p> <p>12.8 Add labor charge with the cost of material for the summary of estimate.</p> <p>12.9 Maintain the record of performed task.</p>	2	2

13	<p>PREPARE AN ESTIMATE FOR RE-WIND OF A SINGLE-PHASE INDUCTION MOTOR</p> <p>13.1 Calculate the size of conductor, number of coils and number of turns in a coil.</p> <p>13.2 Sketch winding diagram of the induction motor.</p> <p>13.3 Make necessary grouping on the basis of the layout plan for winding.</p> <p>13.4 Find out the types and sizes of wire required for the winding.</p> <p>13.5 Determine the number of turns required on the basis of the coil grouping per phase and layer of winding.</p> <p>13.6 Estimate the cost involved to rewind the motor.</p> <p>13.7 Maintain the record of performed task.</p>	1	2
14	<p>PREPARE AN ESTIMATE FOR RE-WIND OF A THREE-PHASE INDUCTION MOTOR</p> <p>14.1 Calculate the size of conductor, number of coils and number of turns in a coil.</p> <p>14.2 Sketch winding diagram of the induction motor.</p> <p>14.3 Make necessary grouping on the basis of the layout plan for winding.</p> <p>14.4 Select wires required for the winding.</p> <p>14.5 Determine the number of turns required on the basis of the coil grouping per phase and layer of winding.</p> <p>14.6 Estimate the cost involved to rewind the motor.</p> <p>14.7 Maintain the record of performed task.</p>	1	2
15	<p>PERFORM INSTALLATION OF PLATE EARTHLING.</p> <p>15.1 Select earth electrode, earth continuity conductor & other necessary materials.</p> <p>15.2 Draw the layout diagram of Plate earthing.</p> <p>15.3 Sketch the layout diagram of Plate earthing by E-CAD.</p> <p>15.4 Place the earth electrode into the ground after digging hole.</p> <p>15.5 Put charcoal & salt into the hole.</p> <p>15.6 Pull the continuity conductor from the earth electrode.</p> <p>15.7 Measure the earth resistance.</p> <p>15.8 Maintain the record of performed task.</p>	2	3
16	<p>PERFORM INSTALLATION OF PIPE EARTHLING.</p> <p>16.1 Select earth electrode, earth continuity conductor & other necessary materials.</p> <p>16.2 Draw the layout diagram of Plate earthing.</p> <p>16.3 Sketch the layout diagram of Plate earthing by E-CAD.</p> <p>16.4 Place the earth electrode into the ground after digging hole.</p> <p>16.5 Put charcoal & salt into the hole.</p>	2	3

	<p>16.6 Pull the continuity conductor from the earth electrode.</p> <p>16.7 Measure the earth resistance.</p> <p>16.8 Maintain the record of performed task.</p>		
17	<p>PERFORM INSTALLATION OF SHEET EARTHLING.</p> <p>17.1 Select earth electrode, earth continuity conductor & other necessary materials.</p> <p>17.2 Draw the layout diagram of Plate earthing.</p> <p>17.3 Sketch the layout diagram of Plate earthing by E-CAD.</p> <p>17.4 Place the earth electrode into the ground after digging hole.</p> <p>17.5 Put charcoal & salt into the hole.</p> <p>17.6 Pull the continuity conductor from the earth electrode.</p> <p>17.7 Measure the earth resistance.</p> <p>17.8 Maintain the record of performed task.</p>	2	3
18	<p>PREPARE AN ESTIMATE FOR INDOOR SUBSTATION</p> <p>18.1 Identify the equipment, measuring instrument, controlling devices and protective devices of indoor substation.</p> <p>18.2 Draw the layout diagram of an indoor substation.</p> <p>18.3 Sketch the layout diagram of an indoor substation by E-CAD.</p> <p>18.4 Prepare an estimate of an indoor substation.</p> <p>18.5 Maintain the record of performed task.</p>	1	2
19	<p>TEST AN ELECTRICAL INSTALLATION (MACHINE / EQUIPMENT) BEFORE COMMISSIONING.</p> <p>19.1 Select the machine/equipment to be tested.</p> <p>19.2 Test continuity of the winding of the machine/equipment by AVO meter.</p> <p>19.3 Test the insulation resistance within the coils by Megger.</p> <p>19.4 Test the insulation resistance with the coils and body of the machine/equipment by Megger.</p> <p>19.5 Measure the resistance of the earth point which will be connected to the body of the machine/equipment.</p> <p>19.6 Maintain the record of performed task.</p>	1	2
20	<p>PREPARE PLAN AND ESTIMATE OF A SHORT DISTRIBUTION LINE.</p> <p>20.1 Take the measurements of the route of the proposed distribution line.</p> <p>20.2 Sketch the route showing substation, pole and consumer.</p> <p>20.3 Sketch the route showing substation, pole and consumer by E-CAD.</p> <p>20.4 Prepare estimate of a short distribution line.</p> <p>20.5 Maintain the record of performed task.</p>	1	2
	Total	32	50

Necessary Resources (Tools, equipment's and Machinery):

SI	Item Name	Quantity
01	Screw drivers, Neon tester, Pliers, Chisels, Hammer, Mallet, Hack saw, Hand saw, Soldering Iron, Electrician Knife, Wire strippers, Poker, Plumb bob, Hand drill machine, measuring tape	Each item 25 no's
02	Lux meter, SWG, Ohm meter, AVO meter, Energy meter, Tacko meter and Megger	Each item 15 no's
03	Rowel plug, Clump, Steel nail, wall hook, Earth plate, GI pipe, Earth continuity conductor, Earth sheet, Charcoal, Salt,	Each item 50 no's
04	Different types of Wires and Cables (1.0 to 3.5mm)	5 coils of different sizes
05	Switches (SPST, SPDT, SPTT, DPST, DPDT, DPTS, TPST, TPDT, TPTT, Tumbler switch, Push bottom switch, Piano switch, Gang switch, two pin socket, three pin socket, Combined switch and socket, two pin plug, Three pin Plug, Adaptor,	Each item 10 no's
06	Incandescent Lamp, Fluorescent lamp, Mercury lamp, Vapor lamp, LED, LCD, LED tube light,	Each item 25 no's
07	Channel of different dimension, Conduit of different dimension, Shackle, Bend, Calling bell, Choke coil, Starter	Each item 25 no's
08	Batten holder, Pendent holder, Bracket holder, Tube light holder set	Each item 25 no's

Recommended Books:

SI	Book Name	Writer Name	Publisher Name & Edition
01	A course in Electrical Installation, Estimating and costing	J B Gupta	S.Chand, 2021
02	Electrical Installation, planning and costing	Uppal	S.Chand2020
03	Electrical Estimating	Michael Halt	McGrogill, 2019
04	PDB, PGCB,PWD Rate schedule	PWD, BD	Dhaka, 2018
05	National Building Code	BNBC	BNBC 2015

Website References:

SI	Web Link	Remarks
01	http://www.electricalengineering.org	
02	http://www.electrical-installation.org	
03	http://www.eetiimes.eu	
04	http://www.interestingengineering.com	
05	http://www.electrical-engineering-portal.com	
06	http://www.electrical4u.com	

Subject Code	Subject Name	Period per Week		Credit
26742	DC Machine	T	P	C
		3	3	4

Rationale	<p>Diploma in Engineering Level students are required to acquire the knowledge and skill on the area of DC Machines with special emphasis of basic concept of Cell & Battery, Fuel cell, procedure of Battery charging and testing, DC generator and its characteristics, Losses and Efficiency of DC generator, DC motor, Speed control and voltage regulation of DC motor, Industrial Application of DC motor, electric traction. Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. As such the knowledge of DC Machine the pre-requisite for these fields for effective discharge of their duties. These necessities of electrical engineering subjects in the curriculum of Diploma in engineering. After completion of this course student will be able to construct Cell & Battery, Perform Battery charging and testing, assemble and re-assemble of DC Generator, Operate DC generator and motor, develop lap and wave winding and speed control of DC motor. Have been given more emphasis on practical aspect rather than theory in teaching learning approach.</p>
Learning Outcome (Theoretical)	<p>After Completing the subject, students will be able to:</p> <ul style="list-style-type: none"> ▪ Define cell, fuel cell and battery. ▪ Illustrate procedure of Battery charging and testing. ▪ Outline DC generator and its characteristics. ▪ Calculate Losses and Efficiency of DC generator. ▪ Describe DC motor. ▪ Enumerate Speed control and Regulation of DC motor ▪ Explain Industrial Application of DC motor. ▪ Mention electric traction.
Learning Outcome (Practical)	<p>After undergoing the subject, students will be able to:</p> <ul style="list-style-type: none"> ▪ Construct cell, fuel cell and battery. ▪ Perform Battery charging and testing. ▪ Assemble and de-assemble of varies parts of D.C. Generator ▪ Operate DC shunt, series and compound motors ▪ Develop Lap and wave winding. ▪ Execute speed control on DC Motors. ▪ Demonstrate Industrial Application of DC motor.

Detailed Syllabus (Theory)

Unit	Topics with contents	Class (1 Period)	Final Marks
1.	<p>CELL AND BATTERY</p> <p>1.1 Define cell, Primary cell and Secondary cell. 1.2 Classify cell and Primary cell. 1.3 Explain Series, Parallel and combined cell connection 1.4 Describe the construction and principle of a simple voltaic cell. 1.5 List the defects of a simple voltaic cell. 1.6 Illustrate the causes and methods of removing of defects of a Simple voltaic cell. 1.7 Mention the construction of Dry cell and its chemical reaction. 1.8 Solve problem related cell combination/connection. 1.9 Illustrate the construction of alkaline batteries. 1.10 Describe the construction of lead acid battery and its chemical reaction</p>	4	8
2	<p>FUEL CELLS</p> <p>2.1 Discuss the concept of Fuel cell. 2.2 Mention the types of Fuel cell. 2.3 Describe the proton exchange membrane fuel cell (PEMFC) and phosphoric acid fuel cell (PAFC). 2.4 Explain the solid acid fuel cell (SAFC) and alkaline fuel cell (AFC). 2.5 Illustrate the High Temperature Fuel Cell of Solid Oxide Fuel Cell (SOFC), Molten carbonate fuel cells (MCFC). 2.6 Mention the uses of PEMFC, PAFC, SAFC, SOFC, MCFC and AFC.</p>	3	6
3	<p>BATTERY CHARGING</p> <p>3.1 List the types of battery charging system. 3.2 Describe the procedure of slow charging of battery by 220-230VAC source. 3.3 Describe the procedure of quick charging of battery by 220-230VAC source. 3.4 Illustrate the procedure of preparing electrolyte. 3.5 Outline the construction of dry charged battery. 3.6 Explain the charging procedure of sulfated battery. 3.7 Describe the process of charging more than one battery at a time.</p>	3	6
4	<p>EFFICIENCY AND TESTING OF BATTERIES</p> <p>4.1 Describe the internal resistance and efficiency of a battery. 4.2 Explain Ampere – Hour (A - H) rating of battery. 4.3 Solve problems related with internal resistance affecting terminal voltage. 4.4 List the factors on which the capacity of a battery depends. 4.5 Illustrate the procedures of testing a storage battery by</p>	4	6

	<p>hydrometer, voltmeter and ammeter.</p> <p>4.6 State the maintenance and routine inspection procedure of a battery.</p>		
5	<p>ELECTROPLATING</p> <p>5.1 Explain fundamental principles of electroplating.</p> <p>5.2 State Faraday's laws of electrolysis.</p> <p>5.3 Describe the process of extraction and refining of metals.</p> <p>5.4 Mention a simple method of producing copper plating upon a carbon brush.</p> <p>5.5 Illustrate electro-deposition process.</p> <p>5.6 Mention power supply for electrolytic process adopted in electroplating.</p>	3	6
6	<p>DC GENERATOR</p> <p>6.1 State generator principle.</p> <p>6.2 Mention the conditions for generation of emf in a single coil generator.</p> <p>6.3 Describe the constructional details of a DC generator.</p> <p>6.4 Derive the EMF equation of a DC generator.</p> <p>6.5 Solve problems relating to DC generator.</p> <p>6.6 Describe the excitation of DC generator.</p> <p>6.7 Explain the necessity of excitation.</p> <p>6.8 Self-excited and separately excited generator.</p> <p>6.9 State the condition for excitation.</p>	4	7
7	<p>WINDING OF DC GENERATOR</p> <p>7.1 Define pole pitch, coil pitch, front pitch, back pitch, average pitch and commutation pitch.</p> <p>7.2 Describe lap and wave winding.</p> <p>7.3 Sketch the developed diagram of simplex and duplex (lap and wave) winding.</p> <p>7.4 Differentiate between the lap and wave windings.</p>	3	6
8	<p>ARMATURE REACTION AND COMMUTATION OF DC GENERATOR</p> <p>8.1 Explain armature reaction.</p> <p>8.2 Describe the effect of armature reaction.</p> <p>8.3 State de-magnetizing and cross magnetizing.</p> <p>8.4 Define the action of commutation.</p> <p>8.5 Mention the methods of improving commutation.</p> <p>8.6 Explain the necessity of interpoles and compensating winding.</p> <p>8.7 State the need for equalizing bar and rings.</p>	3	6
9	<p>CHARACTERISTICS OF DC GENERATOR</p> <p>9.1 Explain the process of building up voltage of shunt generator.</p> <p>9.2 State the critical resistance and critical speed for shunt generator.</p> <p>9.3 Plot the terminal voltage Vs load current characteristic curve of shunt generator.</p> <p>9.4 Describe the reasons for decreasing terminal voltage with increasing load.</p>	3	6

	<p>9.5 Plot the internal and external characteristic curve of DC shunt, series and compound generator.</p> <p>9.6 Solve the problems related to shunt generator.</p>		
10	<p>VOLTAGE REGULATION AND EFFICIENCY OF A DC GENERATOR</p> <p>10.1 List the various losses in a DC generator.</p> <p>10.2 Explain power stages of a DC generator.</p> <p>10.3 Calculate the condition for maximum efficiency.</p> <p>10.4 Derive the formula for voltage regulation of a DC generator.</p> <p>10.5 Discuss the importance of voltage regulation of DC generator.</p> <p>10.6 Solve problems relating to voltage regulation of DC Generator.</p> <p>10.7 Express the formula for efficiency of a DC generator.</p> <p>10.8 Solve problems relating to efficiency of a DC generator.</p>	3	6
11	<p>PARALLEL OPERATION OF DC GENERATOR</p> <p>11.1 State the need for parallel operation of DC generator (shunt, series and compound)</p> <p>11.2 List the conditions for parallel operation of DC generator.</p> <p>11.3 Discuss the condition of sharing loads in DC generators operating in parallel.</p> <p>11.4 Draw the circuit diagram of two long shunt compound generators connected in parallel.</p> <p>11.5 Calculate the load shared by individual machine at the time of parallel operation.</p>	4	6
12	<p>WORKING PRINCIPLE OF DC MOTOR</p> <p>12.1 Explain the working principle of DC motor.</p> <p>12.2 List the types of DC motor</p> <p>12.3 Describe generator action of DC motor.</p> <p>12.4 Discuss the significance of the back emf.</p> <p>12.5 Derive the voltage equation of DC motor.</p> <p>12.6 Define torque, running torque and break down torque with unit.</p> <p>12.7 State different torque and force.</p> <p>12.8 Plot the torque/speed curve of series, shunt and compound motors.</p>	3	5
13	<p>LOSSES AND EFFICIENCY OF DC MOTOR</p> <p>13.1 State the losses in DC motor.</p> <p>13.2 Calculate the efficiency of DC motor from a given data.</p> <p>13.3 Explain the power stages of DC motor.</p> <p>13.4 Solved problem related to efficiency of DC motor.</p>	2	6
14	<p>STARTING METHODS AND SPEED CONTROL OF DC MOTOR</p> <p>14.1 Describe the factors controlling the speed of DC motor.</p> <p>14.2 Discuss the general methods of speed control of DC motor.</p> <p>14.3 Explain speed control of shunt, series and compound motor.</p> <p>14.4 Describe Ward-Leonard System for DC motor speed control.</p> <p>14.5 Express Solid-State speed controller for DC motor (SCR based)</p> <p>14.6 Describe electric braking of shunt and series motor.</p>	3	5

	14.7 Explain the necessity of a starter for DC motor. 14.8 Describe three point and four-point starter used in DC motor. 14.9 Explain the heating and cooling of DC machine. 14.10 Explain brake test and no-load test of DC motor.		
15	ELECTRIC TRACTION SYSTEM 15.1 State electric traction. 15.2 List the characteristics of an ideal traction system. 15.3 Describe the feeding and distribution system for tram ways and trolley buses. 15.4 Explain the diesel electric drive, battery electric drive and electric drive of locomotives. 15.5 Explain the working principle of tram ways and trolley buses. 15.6 Describe the DC system used in traction. 15.7 Explain the reasons for using DC series motor for traction purpose. 15.8 Discuss different methods of speed control of DC traction motors. 15.9 Explain starting method of 3-phase induction motor used in traction. 15.10 Describe the systems of supplying power in electric traction.	3	5
	TOTAL	48	90

Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
1	MAKE A VOLTAIC CELL 1.1 Collect tools and necessary materials for making a voltaic cell. 1.2 Sketch the connection diagram. 1.3 Connect all components according to diagram. 1.4 Observe the chemical reaction. 1.5 Measure the output voltage. 1.6 Maintain the record of performed task.	1	2
2	PERFORM CHARGE A LEAD ACID BATTERY. 2.1 Sketch the connection diagram for constant potential/Constant current method of charging. 2.2 Identify the equipment and materials for charging a lead acid battery. 2.3 Record the readings by measuring the terminal voltage of the discharged battery and specific gravity of electrolytes. 2.4 Connect the positive and negative terminal of the battery to the positive and negative terminals of the charger respectively. 2.5 Set the charging voltage and switch on the charger.	1	3

	<p>2.6 Record the readings by measuring the specific gravity of electrolyte and the terminal voltage of the battery.</p> <p>2.7 Maintain the record of performed task.</p>		
3	<p>MEASURE THE INTERNAL RESISTANCE OF A BATTERY.</p> <p>3.1 Sketch necessary circuit diagram.</p> <p>3.2 Connect a resistance (known value) with the battery.</p> <p>3.3 Record the readings by measuring the voltage and current of the battery.</p> <p>3.4 Calculate the internal resistance of a battery</p> <p>3.5 Maintain the record of performed task.</p>	1	3
4	<p>DE-ASSEMBLE AND RE-ASSEMBLE THE PARTS OF A DC GENERATOR/ DC MOTOR.</p> <p>4.1 Select the necessary tools required for de-assembling and re-assembling the parts of DC generator/ DC motor.</p> <p>4.2 Identify at least ten main parts of the generator/motor.</p> <p>4.3 Sketch at least ten main parts of the generator/motor.</p> <p>4.4 Re-assemble the parts of the generator/motor.</p> <p>4.5 Connect the generator/motor to the proper power source.</p> <p>4.6 Start the generator/motor.</p> <p>4.7 Maintain the record of performed task.</p>	2	3
5	<p>DEVELOP 4 POLES, 24 SLOTS; DOUBLE LAYER LAP WINDING (SIMPLEX & DUPLEX) OF A DC GENERATOR.</p> <p>5.1 Select pole pitch, back pitch, front pitch and commutator pitch for the generator.</p> <p>5.2 Sketch the developed winding diagram (simplex and duplex) showing the position of carbon brushes.</p> <p>5.3 Select the coil turns, coil number and coil grouping for the winding.</p> <p>5.4 Select the sizes and types of wires required for the winding.</p> <p>5.5 Construct required number of coils.</p> <p>5.6 Insert the coils into the slot using the proper insulation.</p> <p>5.7 Connect the coils in proper way.</p> <p>5.8 Test the winding step by step.</p> <p>5.9 Maintain the record of performed task.</p>	2	3
6	<p>DEVELOP A 4 POLES, 16 SLOTS, DOUBLE LAYER WAVE WINDING (SIMPLEX & DUPLEX) OF A DC GENERATOR.</p> <p>6.1 Identify pole pitch, back pitch, front pitch, commutator pitch.</p> <p>6.2 Sketch the developed winding diagram (simplex & duplex) showing the position of carbon brushes.</p> <p>6.3 Determine the number of turns required on the basis of coil grouping and layer of winding.</p> <p>6.4 Determine the size and type of wires required for the winding.</p>	1	3

	6.5 Perform winding. 6.6 Maintain the record of performed task.		
7	DETERMINE GENERATED EMF OF A DC SHUNT GENERATOR. 7.1 Sketch the required diagram of the shunt generator. 7.2 Set the experiment as per diagram. 7.3 Start the generating set and build up the voltage. 7.4 Measure the developed emf by starting the generator. 7.5 Record the required data. 7.6 Plot the I_f versus V_g curve from the data. 7.7 Maintain the record of performed task.	1	2
8	PLOT THE V_L- I_L CHARACTERISTIC CURVES OF A SHUNT GENERATOR. 8.1 Sketch the required diagram for the experiment. 8.2 Collect the materials, meters and equipment required for the experiment. 8.3 Connect all the meters and equipment as per diagram. 8.4 Record the necessary readings from the meters. 8.5 Plot the V_L - I_L curve from the data. 8.6 Maintain the record of performed task.	2	2
9	PLOT THE V_L - I_L CHARACTERISTIC CURVE OF A SERIES GENERATOR. 9.1 Sketch the required diagram for the experiment. 9.2 Collect the required instruments & materials. 9.3 Connect all the meters and equipment as per diagram. 9.4 Record the necessary readings from the meters. 9.5 Plot the V_L - I_L curve from the data. 9.6 Maintain the record of performed task.	2	2
10	PLOT THE V_L- I_L CHARACTERISTIC CURVE OF A COMPOUND GENERATOR. 10.1 Sketch the required diagram for the experiment. 10.2 Collect the required instruments & materials. 10.3 Connect all the meters and equipment as per diagram. 10.4 Record the necessary readings from the meters. 10.5 Plot the V_L - I_L curve from the data. 10.6 Maintain the record of performed task.	3	2
	Total	16	25

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

Sl	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, Wattmeter, Megger	Each item 10 no's
03	Voltaic cell, Fuel cell, Lead Acid Battery, Battery	Each item 08 no's

	charging Unit, Ampere Tube, Cotton tap, Leather wage paper, Insulation varnish	
04	DC motor & DC generator set ,3- Point and 4- point starter	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
08	Super enamel copper wire	As per required

SI	Book Name	Writer Name	Publisher Name & Edition
01	A Text Book of Electrical Technology	B. L. Theraja	S.Chand, Millenium Edition
02	Electrical Machines	Charles Siskind	2nd edition
03	DC Machines	Samadder & Gongopadhya	2021` edition
04	A course in Electrical Power	J. B. Gupta	Katson books
05	Electric Machinery fundamentals	Stephen J. Chapman	Mc Grew Hill international, Fourth Edition.

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	
26743	Electrical Engineering Project-I	T	P	C
		-	6	2

Rationale	<p>Electrical engineering project-1 is one of the most important subjects in respect to prepare and make some of the devices and appliances which are much more important for the diploma engineers. It deals with a single phase transformer, electronic water level controller, battery charger, PCB design, Light Control circuit by PIR sensor, fan regulator (Electronic type), Direct on line stater (DOL), Single phase forward/Reverse motor starter with timer, Motor starter (Electronic type).The students should acquire knowledge, skills and attitude regarding electrical Project to make some of the equipment which are very much effective to create and innovate the idea and thinking to make and build project as well as task that will helpful to be an self-employer and entrepreneur.</p>
Learning Outcome (Practical)	<p>After undergoing the subject, students will be able to</p> <ol style="list-style-type: none"> 1. Make a single phase transformer. 2. Make a electronic water level controller. 3. Make printed circuit board (PCB). 4. Construct a emergency light circuit 5. Make a battery charger 6. Construct light control circuit by PIR sensor. 7. Construct a fan regulator (Electronic type). 8. Make a direct on line starter (DOL) 9. Construct a single phase forward and reverse motor starter with timer 10. Construct a motor starter (Electronic type).

DETAILED SYLLABUS (PRACTICAL)

SL.no	Experiment Name	Class (3 Period)	Marks (Continuous)
1	<p>MAKE A 100VA SINGLE PHASE TRANSFORMER.</p> <p>1.1 Select the rating of a single phase transformer. 1.2 Design and calculate the core size, wire size and number of turns. 1.3 Collect the materials required for construct the transformer. 1.4 Draw the working diagram for the transformer. 1.5 Wind wire on the bobbin, Warp winding properly. 1.6 Pour varnish to the winding and bake. 1.7 Insert core into the bobbin. 1.8 Test the transformer on no-load and on-load. 1.9 Maintain the record of performed task.</p>	3	5
2	<p>CONSTRUCT ELECTRONIC WATER LEVEL CONTROLLER.</p> <p>2.1 Design the water level controller circuit. 2.2 Draw the circuit diagram. 2.3 Collect the materials required. 2.4 Sketch the layout plan of water level controller. 2.5 Set the different parts. 2.6 Make the water level controller. 2.7 Test the performance of controller. 2.8 Maintain the record of performed task.</p>	3	5
3	<p>MAKE PRINTED CIRCUIT BOARD (PCB)</p> <p>3.1 Draw the circuit diagram on the copper clay board. 3.2 Etch copper clay board by ferric chloride solution. 5.3 Wash the PCB with water. 3.4 Neutralize the PCB with diluted HCL or Thinner 3.5 Maintain the record of performed task.</p>	2	5
4	<p>CONSTRUCT A EMERGENCY LIGHT CIRCUIT.</p> <p>4.1 Draw the circuit diagram. 4.2 Collect the materials required. 4.3 Make PCB according to circuit diagram. 4.4 Assemble the components. 4.5 Supply power and observe the performance. 4.6 Maintain the record of performed task.</p>	3	5
5	<p>MAKE A 12V BATTERY CHARGER.</p> <p>5.1 Draw the circuit diagram. 5.2 Calculate the input and output related data for battery charger. 5.2 Select component and materials 5.3 Collect the materials required. 5.4 Assemble the components. 5.5 Supply power and observe the performance.</p>	4	5

	5.6 Maintain the record of performed task.		
6	CONSTRUCT LIGHT CONTROL CIRCUIT BY PIR SENSOR. 6.1 Draw the circuit diagram. 6.2 Select a PIR sensor, relay, light, wire etc. 6.3 Make PCB according to circuit diagram. 6.4 Assemble the components. 6.5 Connect the circuit with light load. 6.6 Energized electric supply to light and sensor circuit. 6.7 Test the constructed circuit. 6.8 Maintain the record of performed task.	2	5
7	CONSTRUCT A FAN REGULATOR (ELECTRONIC TYPE). 7.1 Select the speed regulating circuits for making a fan regulator. 7.2. Collect the materials & accessories required. 7.3 Prepare circuit with proper connection. 7.4 Test the constructed circuit. 7.5 Set the base and cover. 7.6 Maintain the record of performed task..	3	5
8	MAKE A DIRECT ON LINE STARTER (DOL). 8.1 Design the Direct on line starter (DOL). 8.2 Draw the circuit diagram. 8.3 Collect the materials & accessories required. 8.4 Construct circuit with proper connection. 8.5 Connect with a motor. 8.6 Energized electric supply. 8.7 Cheek overload relay by test trip knob. 8.8 Maintain the record of performed task.	4	5
9	CONSTRUCT A SINGLE PHASE FORWARD AND REVERSE MOTOR STARTER WITH TIMER. 9.1 Design the forward reverse motor starter 9.2 Draw the circuit diagram. 9.3 Collect the materials & accessories required. 9.4 Construct circuit with proper connection. 9.5 Connect with a motor. 9.6 Energized the electric supply. 9.7 Change timer time set. 9.8 Maintain the record of performed task..	4	5
10	CONSTRUCT A MOTOR STARTER (ELECTRONIC TYPE). 10.1 Draw the circuit diagram. 10.2 Make PCB according to circuit diagram. 10.3 Collect the materials & accessories required. 10.4 Construct circuit with proper connection. 10.5 Connect with a motor. 10.6 Energized electric supply. 10.7 Maintain the record of performed task..	4	5
	Total	32	50

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

SI	Item Name	Quantity
01	Transformer core	As Necessary
02	Bobbin	As Necessary
03	Super enamel wire	As Necessary
04	Insulating varnish	As Necessary
05	Transformer 220/12V	As Necessary
06	Bridge rectifier	As Necessary
07	Capacitor	As Necessary
08	Relay	As Necessary
09	Copper clay board (CCB)	As Necessary
10	Ferric chloride powder	As Necessary
11	Permanent marker pen	As Necessary
12	Thinner	As Necessary
13	Rechargeable battery	As Necessary
14	PIR sensor	As Necessary
15	Vero board	As Necessary
16	Triac (BT 136 or Any)	As Necessary
17	Diac	As Necessary
18	Variable resistance (500k Ω)	As Necessary
19	Magnetic contact	As Necessary
20	Thermal over load relay	As Necessary
21	Push switch	As Necessary
22	Steel cabinet	As Necessary
23	Timer	As Necessary

RECOMMENDED BOOKS:

SI	Book Name	Writer Name	Publisher Name & Edition
01	Electrical & Electronic Projects	Shukla Nikhil	V & S Publishers, 2014
02	Basic Electrical Engineering Practical Knowledge	M.M. Khoibar Ali	Prabhathi Engineering shall Publications
03	Practical Transformer Handbook	Irving Gottlieb	Newnes
04	Design of Transformer	Indrojit Dasgupta	Mc Graw-Hill

WEBSITE REFERENCES:

SI	Web Link	Remarks
01	www.youtube.com	Search here with topics
02	www.google.com	Search here with topics

Subject Code	Subject Name	Period per Week		Credit
26845	Digital Electronics	T	P	C
		3	3	4

Rationale	<p>This is a sector specific course of diploma in engineering program required for enabling the graduates to use and work with ICT. It includes Concept of digital electronics, Number system and binary arithmetic operation, Arithmetic codes and code conversion, Concept of logic gates, Electronic circuit of logic gates, Digital ic's Logic families, Logic simplification & circuit design, Combinational logic circuits, Encoder and decoder, Multiplexers and DE-Multiplexer, Sequential logic circuits. This course designed emphasis will be more on teaching practical aspect rather than theory.</p>
Learning Outcome (Theoretical)	<p>After undergoing the subject, students will be able to:</p> <ul style="list-style-type: none"> • Describe Concept of digital electronics. • Explain Number system and binary arithmetic operation. • State Codes and code conversion • Discuss Concept of logic gates. • Describe Electronic circuit of logic gates. • Explain Digital ic's • Interpret Logic families. • State Logic simplification & circuit design. • Illustrate Combinational logic circuits. • Describe Encoder and decoder. • Discuss Multiplexers and De-multiplexer. • State Sequential logic circuits.
Learning Outcome (Practical)	<p>After undergoing the subject, students will be able to:</p> <ul style="list-style-type: none"> ▪ Verify the truth tables of logic gates (OR, AND, NOT, NAND & NOR). ▪ Verify the truth table of X-OR & X-NOR gate using basic gates. ▪ Show the operation of NAND & NOR gate as universal gates. ▪ Design & develop a code converter circuit and observe its output operation. ▪ Verify the functions of half adder & half sub tractor. ▪ Verify the functions of full adder & full sub tractor. ▪ Verify the output operation of binary 4-bit parallel adder. ▪ Show the operation of encoder & decoder. ▪ Show the operation of a decoder driver & display operation using 7 segments Display. ▪ Show the operation of multiplexer & demultiplexer. ▪ Verify the truth table of different S-R & D type flip-flops. ▪ Verify the operation of binary comparator.

Detailed Syllabus (Theory)

Unit	Topics with Contents	Period	Marks
1	CONCEPT OF DIGITAL ELECTRONICS 1.1 Define digital electronics & digital signal. 1.2 Mention the characteristics of digital signal. 1.3 State the advantages of working in digital mode. 1.4 State logic level of digital signal. 1.5 Mention the parameters of a digital pulse waveform. 1.6 Describe rise time, fall time, pulse width and duty cycle.	3	6
2	NUMBER SYSTEM AND BINARY ARITHMETIC OPERATION 2.1 Describe decimal, binary, octal and hexadecimal number system. 2.2 Convert one number system to another. 2.3 Compute binary arithmetic. 2.4 State 1's & 2's Complement.	3	8
3	CODES AND CODE CONVERSION 3.1 State BCD code, Excess-3 code, Gray code, Unicode and ASCII code. 3.2 Convert one code to another. 3.3 Describe the addition and subtraction of Excess-3 and BCD code. 3.4 State parity bit error checking code and Hamming code. 3.5 Describe the error detection and correction procedure with Hamming code.	3	7
4	LOGIC GATES 4.1 Define logic gate. 4.2 Classify logic gate. 4.3 Explain logical expression, truth table and symbol of AND, OR, NOT, NOR, NAND, EX-OR and EX-NOR gates. 4.4 Define Universal logic gates. 4.5 Explain NAND & NOR gates used as Universal logic gates. 4.6 State the applications of logic gates.	4	8
5	ELECTRONIC CIRCUIT OF LOGIC GATES 5.1 Explain Equivalent circuit of basic gates. 5.2 Describe the operation of standard TTL NAND gate. 5.3 Describe the operation of CMOS and NOR gates. 5.4 Describe the operation of Tri-states buffer gate.	3	7
6	DIGITAL IC'S 6.1 Define Digital IC's. 6.2 State the characteristics of digital IC's. 6.3 Mention IC package, code numbers, and important specification of TTL/MOS commercial IC of basic logic gates. 6.4 Mention the applications of different logic IC's.	2	5
7	LOGIC FAMILIES 7.1 Define logic families. 7.2 Classify logic families. 7.3 Define SSI, MSI, LSI and VLSI. 7.4 Define Transistor logic families and MOS logic families . 7.5 Describe Diode transistor logic -DTL & Transistor transistor logic-TTL. 7.6 Describe P-MOS, N-MOS & C-MOS. 7.7 State propagation delay time, speed, noise immunity, power dissipation, fan-in, fan-out, operating temperature and power	3	7

	rating of logic IC's.		
8	LOGIC SIMPLIFICATION & CIRCUIT DESIGN 8.1 State the theorems of Boolean algebra. 8.2 State De Morgan's theorems. 8.3 Mention the applications of De Morgan's theorems. 8.4 State Sum of Product (SOP) and Product of Sum (POS). 8.5 Mention the SOP & POS from truth table. 8.6 Define Karnaugh map. 8.7 State the structure of Karnaugh map. 8.8 State the simplification process of Boolean expression from a Karnaugh map and design logic circuit (up to 4 variables). 8.9 Problems solves above theorem.	4	9
9	COMBINATIONAL LOGIC CIRCUITS 9.1 Define combinational logic circuit with example. 9.2 Describe the operation of half adder and Sub tractor. 9.3 Explain the operation of full adder and Sub tractor. 9.4 Describe the operation of 4 bit parallel adder. 9.5 Explain the operation of multipliers & divisors.	4	9
10	ENCODER 10.1 Define Encoder. 10.2 Describe the logic diagram and operation of (4/8 bit) encoder. 10.3 Illustrate the working principle of LCD, LED, Seven-segment and Dot matrix display. 10.4 Describe the operation of parity generator & detector circuits with diagram.	4	8
11	DECODER 11.1 Define Decoder. 11.2 Describe the logic diagram and operation of (4/8 bit) decoder. 11.3 Sketch the diagram of commonly used 4-bit BCD decoder/driver for seven segment display of common Anode/Cathode type.		
12	MULTIPLEXERS 12.1 State Multiplexer . 12.2 Describe the operation of 2:1, 4:1 and 8:1 Multiplexers with logic diagram. 12.3 State the uses of Multiplexer .	3	8
13	DEMULTIPLEXER. 13.1 State Demultiplexer. 13.2 Describe the operation of 1:2, 1:4 and 1:8 Demultiplexers with logic diagram. 13.3 State the uses of Demultiplexer. 13.4 Explain the operation of 4-bit Binary comparator.		
14	SEQUENTIAL LOGIC CIRCUITS. 14.1 State sequential logic circuit 14.2 Define clock, timing diagram & latch of digital system. 14.3 Explain the operation of basic SR latch, D flip-flop, clocked flip-flop, J-K flip-flop, T flip-flop & J-K master-slave flip-flop. 14.4 State the concept of positive & negative edge triggering and level triggering.	3	8
	Total	48	90

Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Marks
1	VERIFY THE TRUTH TABLES OF LOGIC GATES (OR, AND, NOT, NAND & NOR) 1.1 Select the logic gate ICs. 1.2 Select appropriate required tools, equipment's and materials. 1.3 Insert the IC to the Breadboard. 1.4 Connect and checked the circuits as per diagram on trainer board. 1.5 Switch on the DC power supply, 1.6 Verify the truth tables.	2	2
2	VERIFY THE TRUTH TABLE OF X-OR & X-NOR GATE USING BASIC GATES. 2.1 Select the logic gate ICs. 2.2 Select appropriate required tools, equipment's and materials. 2.3 Insert the IC to the Breadboard. 2.4 Connect and checked the circuits as per diagram on trainer board. 2.5 Switch on the DC power supply, 2.6 Verify the truth tables.	1	2
3	PERFORM THE OPERATION OF NAND & NOR GATE AS UNIVERSAL GATES. 3.1 Select the IC's of NAND gate & NOR gate. 3.2 Select appropriate required tools, equipment and materials. 3.3 Insert the selected IC to the Breadboard. 3.4 Connect and checked the circuits as per diagram for AND OR & NOT gate on trainer board. 3.5 Switch on the DC power supply. 3.6 Verify the truth tables of AND, OR & NOT gate operation.	1	2
4	DESIGN & DEVELOP CODE CONVERTER CIRCUITS AND OBSERVE ITS OUTPUT. 4.1 Select the ICs. 4.2 Select appropriate required tools, equipment and materials. 4.3 Insert the selected IC to the Breadboard. 4.4 Connect and checked the circuits as per diagram on trainer board. 4.5 Switch on the DC power supply, 4.6 Verify the truth tables	1	2
5	OBSERVE THE FUNCTIONS OF HALF ADDER & SUBTRACTOR. 5.1 Select ICs. 5.2 Draw the pin diagram and internal connection. 5.3 Draw appropriate circuits. 5.4 Select required tools, equipment and materials. 5.5 Connect and checked the circuits as per diagram on trainer board. 5.6 Switch on the DC power supply, 5.7 Verify the truth tables.	1	2
6	VERIFY THE FUNCTIONS OF FULL ADDER & FULL SUBTRACTOR. 6.1 Select ICs. 6.2 Draw the pin diagram and internal connection. 6.3 Draw appropriate circuits.	2	2

	<p>6.4 Select required tools, equipment and materials.</p> <p>6.5 Connect and checked the circuits as per diagram on trainer board.</p> <p>6.6 Switch on the DC power supply,</p> <p>6.7 Verify the truth tables.</p>		
7	<p>VERIFY THE OUTPUT OPERATION OF BINARY 4 BIT PARALLEL ADDER.</p> <p>7.1 Select appropriate ICs.</p> <p>7.2 Draw the pin diagram and internal connection.</p> <p>7.3 Draw appropriate circuits.</p> <p>7.4 Select required tools, equipment and materials.</p> <p>7.5 Connect the circuits as per diagram on trainer board.</p> <p>7.6 Switch on the DC power supply,</p> <p>7.7 Verify the truth tables.</p>	1	2
8	<p>SHOW THE OPERATION OF ENCODER & DECODER.</p> <p>8.1 Select appropriate ICs.</p> <p>8.2 Draw the pin diagram and internal connection.</p> <p>8.3 Draw appropriate circuits.</p> <p>8.4 Select required tools, equipments and materials.</p> <p>8.5 Connect and checked the circuits as per diagram on trainer board.</p> <p>8.6 Switch on the DC power supply,</p> <p>8.7 Verify the truth tables.</p>	1	2
9	<p>SHOW THE OPERATION OF 7 SEGMENT DISPLAY DRIVER</p> <p>9.1 Select appropriate ICs.</p> <p>9.2 Draw the pin diagram and internal connection.</p> <p>9.3 Draw appropriate circuits.</p> <p>9.4 Select required tools, equipments and materials.</p> <p>9.5 Connect and checked the circuits as per diagram on trainer board.</p> <p>9.6 Switch on the DC power supply,</p> <p>9.7 Verify the truth tables.</p>	1	2
10	<p>SHOW THE OPERATION OF MULTIPLEXER & DEMULTIPLEXER.</p> <p>10.1 Select appropriate ICs.</p> <p>10.2 Draw the pin diagram and internal connection.</p> <p>10.3 Draw appropriate circuits.</p> <p>10.4 Select required tools, equipments and materials.</p> <p>10.5 Connect and checked the circuits as per diagram on trainer board.</p> <p>10.6 Switch on the DC power supply.</p> <p>10.7 Verify the truth tables.</p>	1	2
11	<p>VERIFY THE TRUTH TABLE OF DIFFERENT S-R & D FLIP-FLOPS.</p> <p>11.1 Select appropriate ICs.</p> <p>11.2 Draw the pin diagram and internal connection.</p> <p>11.3 Draw appropriate circuits.</p> <p>11.4 Select required tools, equipments and materials.</p> <p>11.5 Connect and checked the circuits as per diagram on trainer board.</p> <p>11.6 Switch on the DC power supply,</p> <p>11.7 Verify the truth tables.</p>	1	2
12	<p>VERIFY THE TRUTH TABLE OF DIFFERENT J-K FLIP-FLOPS.</p> <p>12.1 Select appropriate ICs.</p> <p>12.2 Draw the pin diagram.</p>	2	2

	12.3 Draw appropriate circuits. 12.4 Select required tools, equipments and materials. 12.5 Connect and checked the circuits as per diagram on trainer board. 12.6 Switch on the DC power supply, 12.7 Verify the truth tables.		
13	VERIFY THE OPERATION OF BINARY COMPARATOR. 13.1 Select appropriate ICs. 13.2 Draw the pin diagram. 13.3 Draw appropriate circuits. 13.4 Select required tools, equipments and materials. 13.5 Connect and checked the circuits as per diagram on trainer board. 13.6 Switch on the DC power supply. 13.7 Verify the truth tables.	1	1
	Total	16	25

Necessary Resources (Tools, equipment's and Machinery):

SI	Item Name	Quantity
01	DC power supply unit, connecting wire.	1 set per students
02	Bread board ,Trainer Board.	1 set per studens
03	Various type of Logic Gate IC's as defined.	1 set per studens
04	Various type IC's such as Adder, Subtractor, Encoder, Decoder, Multiplexer, Demultiplexer, Binary Comparator, 7 segment display driver etc.	1 set per studens
05	Seven Segment display (Common Anode , common Cathode).	1 set per studens
06	Various type of Flip-Flop IC's(R-S, D, J-K).	1 set per studens

Recommended Books:

SI	Book Name	Writer Name	Publisher Name & Edition
01	Digital Fundamentals	Thomas L. Floyd	
02	Digital Principles	Roger L. Tokhem	
03	Digital system	Ronald J. Tocci and Widmer.	
04	Principle of Digital Electronics & Application	Malvino	

Website References:

SI	Web Link	Remarks
01	https://www.tutorialspoint.com/digital_circuits/index.htm	
02	https://www.tutorialspoint.com/digital_circuits/digital_circuits_logic_gates.htm	
03	https://www.javatpoint.com/digital-electronics	

Subject Code	Subject Name	Period Per Week		Credit
		T	P	
27044	Applied Mechanics	2	3	C
				3

Rationale	<p>Applied mechanics is the part of science concerned with the motion of any substance, examines the response of bodies to external forces. In Electrical Engineering it can be applied in mechatronics and robotics, design and drafting, nanotechnology, machine elements, structure analysis and aerospace engineering.</p> <p>The Student of Diploma in Electrical Engineering Level must be acquired the basic knowledge about calculation, applications and mandatory analysis of Applied Mechanics. Also required basic knowledge of newly introduced Electrical technology and other related analysis & calculation. For self-development must be updated with the latest technology.</p> <p>After successfully completing this course, student will be able to identify Fundamental of mechanics and unit conversion, Stress, Strain, Composition and resolution of forces, Moment of forces, Couples and their applications, Equilibrium of forces, Center of gravity, moment of inertia, Friction, Support reactions force of beam and truss, gear trains and its application.</p>
Learning Outcome (Theoretical)	<p>At the end of the course the students will be able to:</p> <ul style="list-style-type: none"> ▪ State the fundamental of units, conversions of Units, Stress and Strain. ▪ Explain the force, effect of the force, composition and resolution of forces and computing the resultant force ▪ Discuss the parallel forces & couple ▪ Describe the centroid and enable to computing the center of gravity & the moment of inertia ▪ Describe laws of friction and the coefficient of friction & the ability of computing frictional forces of reactions of surfaces ▪ Explain support reactions and describe types of loading on beam and trusses. ▪ State gear trains
Learning Outcome (Practical)	<p>At the end of the course the students will be able to:</p> <ul style="list-style-type: none"> ▪ Determine the resultant force by using force board ▪ Determine the compression load using Jib crane ▪ Determine the equilibrium force by using force table ▪ Determine the center of a triangular & rectangular lamina ▪ Determine the center of gravity of solid body ▪ Determine the co-efficient of friction ▪ Determine the action of load on the member of simple frame or trusses ▪ Determine the balancing of moment ▪ Determine the velocity ratios among the driver and driven gears

Detailed Syllabus (Theory)

Unit	Topics with contents	Class (1 Period)	Final Marks
1	<p>FUNDAMENTAL OF MECHANICS</p> <p>1.1 Define mechanics</p> <p>1.2 Mention the Sub-Divisions of Applied mechanics</p> <p>1.3 State the Importance of units in the engineering field</p> <p>1.4 Discuss the conversion of units</p> <p>1.5 Describe algebra, trigonometry & calculus used in mechanics</p> <p>1.6 Define stress, strain, modulus of elasticity, Poison's ratio.</p> <p>1.7 Explain the stress in composite bar and stress due to change in temperature.</p> <p>1.8 Describe the linear and lateral strain.</p> <p>1.9 Explain the stress strain diagram.</p> <p>1.10 Solve the problems on stress and strain.</p>	3	4
2	<p>COMPOSITION AND RESOLUTION OF FORCES</p> <p>2.1. State the effect and characteristics of a force</p> <p>2.2. Describe different system of forces</p> <p>2.3. Describe resultant force and composition of forces</p> <p>2.4. State resultant force with graphically and analytically</p> <p>2.5. State the laws of forces</p> <p>2.6. Define resolution of a force</p> <p>2.7. Deduce the formula for finding the rectangular components</p> <p>2.8. Describe magnitude and position of the resultant force graphically and analytically</p> <p>2.9. Solve the problems related to resultant force</p>	4	6
3	<p>MOMENT OF FORCES AND COUPLES</p> <p>3.1 Define moment of force</p> <p>3.2 Mention the units of moment</p> <p>3.3 Mention the clockwise and anticlockwise moment</p> <p>3.4 State the Varignon's principle of moments</p> <p>3.5 Define lever and Couple</p> <p>3.6 State the classification of parallel forces</p> <p>3.7 Classify Lever and couple</p> <p>3.8 Solve the problems related to moment of forces and couple</p>	4	6
4	<p>EQUILIBRIUM OF FORCES</p> <p>4.1. State the principles of equilibrium forces</p> <p>4.2. State the Lami's theorem</p> <p>4.3. Derive Lami's theorem</p> <p>4.4. Describe different methods of the equilibrium of coplanar forces and non-coplanar forces</p> <p>4.5. Explain the conditions of equilibrium</p> <p>4.6. Mention types of equilibrium of forces</p> <p>4.7. Solve the problems related to equilibrium of forces</p>	3	6

5	<p>CENTER OF GRAVITY</p> <p>5.1 Define center of gravity and centroid</p> <p>5.2 Distinguish between center of gravity and centroid</p> <p>5.3 Explain the methods to find out centroid of simple geometrical figure</p> <p>5.4 Discuss the axis of reference and axis of symmetry</p> <p>5.5 Find out centroid of rectangle, triangle and semicircle by using geometrically and integration method</p> <p>5.6 Find out centroid of plain geometrical figure by principle of first moments</p> <p>5.7 Calculate the centroid of different geometric figure</p> <p>5.8 Calculate the center of gravity of solid bodies</p> <p>5.9 Solve the problems related to center of gravity</p>	3	6
6	<p>MOMENT OF INERTIA</p> <p>6.1 Describe moment of inertia and the units of moment of inertia</p> <p>6.2 Describe the methods to find out the moment of inertia</p> <p>6.3 Find out the moment of inertia of simple areas by the method of integration</p> <p>6.4 State and proof of the theorem of perpendicular axis as applied to moment of inertia</p> <p>6.5 State the parallel axis theorem in the determination of moment of inertia of areas</p> <p>6.6 Explain the radius of gyration and section modulus</p> <p>6.7 Define mass moment of inertia</p> <p>6.8 Mention the application of mass moment of inertia</p> <p>6.9 Calculate and Solve the problems related to moment of inertia and section modulus of composite sections and simple solid bodies</p>	3	8
7	<p>FRICTION</p> <p>7.1 Define friction</p> <p>7.2 Describe the advantage and disadvantages of friction</p> <p>7.3 Mention the types of friction</p> <p>7.4 State the laws of static and dynamic friction</p> <p>7.5 Explain the angle of friction</p> <p>7.6 Describe the different types of co-efficient of friction</p> <p>7.7 Explain free body diagrams of a body lying on horizontal, inclined and vertical surfaces, ladder and wedge</p> <p>7.8 Calculate the frictional force of a body lying on horizontal and inclined surfaces</p> <p>7.9 Describe the methods to solve the problems of ladder and wedge</p> <p>7.10 Solve the problems related to friction</p>	3	6
8	<p>SUPPORT REACTION FORCES ON BEAM</p> <p>8.1 Define beam</p> <p>8.2 Define support and support reactions</p> <p>8.3 Classify supports</p> <p>8.4 Describe the types of beams</p> <p>8.5 Explain the types of loads on beam</p>	3	6

	8.6 Calculate the support reactions of simple, overhanging and cantilever beam with different loading conditions 8.7 Solve the problems related to support reaction forces on beam		
9	SUPPORT REACTION FORCES ON TRUSS 9.1 Define truss 9.2 Classify truss 9.3 Describe perfect and imperfect truss 9.4 State the method to find out the support reaction and forces on the member of the truss 9.5 Mention the nature of force on the members of truss 9.6 Solve the problem related to truss	3	6
10	GEAR TRAINS 10.1 Define gear 10.2 Mention the types of gear 10.3 Define gear train 10.4 Classify gear train 10.5 Describe simple, compound and epicyclical gear train 10.6 Express the velocity ratio of simple, compound and epicyclical gear train 10.7 Solve the problems related to gear trains	3	6
	Total	32	60

Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
1	DETERMINE THE RESULTANT FORCE BY USING FORCE BOARD 1.1 Set up the force board 1.2 Set up the accessories on the force board 1.3 Find out the resultant force 1.4 Calculate the magnitude of resultant force 1.5 Perform the Comparison of calculated values with experimental values 1.6 Maintain the record of performed task	1	2
2	DETERMINE THE FORCES IN THE MEMBERS OF A JIB CRANE 2.1 Set up the Jib crane 2.2 Set up the accessories on the Jib crane 2.3 Find the compression loads on the Jib 2.4 Calculate the compression analytically 2.5 Compare the experimental values with analytical values 2.6 Maintain the record of performed task	1	3
3	DETERMINE THE EQUILIBRIUM FORCE BY USING FORCE TABLE 3.1 Set up the force table 3.2 Set up the accessories on the force table 3.3 Find the magnitude and direction of a force establishing equilibrium 3.4 Calculate the magnitude and direction of equilibrium force	2	3

	<p>3.5 Compare the calculated values with experimental values</p> <p>3.6 Maintain the record of performed task</p>		
4	<p>DETERMINE THE CENTER OF A TRIANGULAR LAMINA</p> <p>4.1 Select a triangular lamina and a plumb bob</p> <p>4.2 Set up the plumb bob</p> <p>4.3 Find the center point of the triangular lamina</p> <p>4.4 Maintain the record of performed task</p>	1	3
5	<p>DETERMINE THE CENTER OF A RECTANGULAR LAMINA</p> <p>5.1. Select a rectangular lamina and a plumb bob</p> <p>5.2. Set up the plumb bob</p> <p>5.3. Find the center point of the rectangular lamina</p> <p>5.4. Maintain the record of performed task</p>	1	2
6	<p>DETERMINE THE CENTER OF GRAVITY OF SOLID BODY</p> <p>6.1. Select solid rod, step rod and body with cut out holes of solid bodies</p> <p>6.2. Select a fulcrum</p> <p>6.3. Set up the fulcrum</p> <p>6.4. Find the center point</p> <p>6.5. Compare the analytical values with experimental values</p> <p>6.6. Maintain the record of performed task</p>	2	3
7	<p>DETERMINE THE CO-EFFICIENT OF FRICTION</p> <p>7.1 Set up the friction apparatus</p> <p>7.2 Select the materials of which coefficient of friction are to be determined</p> <p>7.3 Place the materials over each other</p> <p>7.4 Raise one end of the body until the other body slides down</p> <p>7.5 Find the angle of friction</p> <p>7.6 Find the co-efficient of friction</p> <p>7.7 Maintain the record of performed task</p>	2	3
8	<p>DETERMINE THE ACTION OF LOAD ON THE MEMBER OF SIMPLE FRAME OR TRUSS</p> <p>8.1 Select two members of which one end roller and other end pin point</p> <p>8.2 Select a tension spring</p> <p>8.3 Make a unit as a simple frame or truss</p> <p>8.4 Apply the load</p> <p>8.5 Read the tension load on spring</p> <p>8.6 Maintain the record of performed task</p>	2	2
9	<p>DETERMINE THE BALANCING OF MOMENT</p> <p>9.1 Set up the bell crank lever</p> <p>9.2 Set up the accessories on the bell crank lever</p> <p>9.3 Compare between clockwise and anticlockwise moment</p> <p>9.4 Read tension on spring balance</p> <p>9.5 Compare the experimental values with analytical values</p> <p>9.6 Maintain the record of performed task</p>	2	2

10	DETERMINE THE VELOCITY RATIOS AMONG THE DRIVER AND DRIVEN GEARS	2	2
	10.1 Set a simple train of gears		
	10.2. Compare the velocity ratios of the same		
	10.3. Set a compound train of gears		
	10.4. Compare the velocity ratios of the same		
	10.5. Maintain the record of performed task		
Total		16	25

Necessary Resources (Tools, equipment's and Machinery):

Sl.	Item Name	Quantity
01	Forces Kit including Work Panel	Each item 5 Set
02	Friction and Inclined Plane Kit including Work Panel	Each item 5 Set
03	Gear Trains Kit including Work Panel	Each item 5 Set
04	Equilibrium of Forces including Statics Works Panel	Each item 5 Set
05	Pin Jointed Frameworks	Each item 5 Set
06	Laptop, Multimedia & Hi-speed internet connection.	Each item 2 Nos

Recommended Books:

Sl.	Book Name	Writer Name	Publisher Name & Edition
01	Applied Mechanics	R. S. Khurmi, J.K Gupta	14th Edition& S. Chand & Company Ltd.
02	Engineering Mechanics	Russell Hibbeler	14 th Edition&
03	A Textbook of Applied Mechanics	R. K. Rajput	4th Edition, Kindle Edition

Sl.	Web Link	Remarks
01	Applied Mechanics -Dynamics	https://www.pdfdrive.com/applied-mechanics-dynamics-d5674220.html
02	A Textbook of Engineering Mechanics	https://books.google.com.bd/url?id=AKEbEAAAQBAJ&pg=PP4&q=http://www.schandpublishing.com&linkid=1&usg=AOvVawOUntnj0xMDuTPARpClepDF&source=gbs_pub_info_r
03	Applied Mechanics	https://www.researchgate.net/publication/340999448_Applied_Mechanics
04	Applied Mechanics	https://www.youtube.com/watch?v=4-oZM1TYjyQ

Website References:

Sl.	Web Link	Experiment name with the procedure	Remarks
01	https://www.youtube.com/watch?v=P Yv8cGQrZN8	Determination of Force and Centre of Gravity	
02	https://www.youtube.com/watch?v=n 1JTt 7BS80	Determination of Friction	
03	https://www.youtube.com/watch?v=m UUCh7ocsvs	Determination of Gear Ratio, Efficiency	

04	https://www.youtube.com/watch?v=jmL-mcjXxHQ	Determination of Equilibrium of Forces	
05	https://www.youtube.com/watch?v=malARO_euBo	Determination of Forces and deflections in different frameworks	
06	https://youtu.be/U5MMgLfSHvA	Determine The Balancing of the Moment	

WEBSITE REFERENCES:

Sl.	Web Link	Remarks
01	www.youtube.com	Search here with topics
02	www.google.com	Search here with topics