



**BANGLADESH TECHNICAL EDUCATION BOARD**

**Agargaon, Sher-E-Bangla Nagar**

**Dhaka-1207.**

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

**ELECTRONICS TECHNOLOGY**

**TECHNOLOGY CODE: 68**

**5<sup>TH</sup> SEMESTER**

**(Effective from 2022-2023 Academic Sessions)**

# DIPLOMA IN ENGINEERING CURRICULUM COURSE STRUCTURE

(PROBIDHAN-2022)

**TECHNOLOGY NAME: ELECTRONICS TECHNOLOGY (68)**

(5th SEMESTER)

Sl. No.	Subject		Period Per Week		Credit	Marks Distribution						
						Theory Assessment			Practical Assessment			Grand Total
	Code	Name	Theory	Practical		Continuous	Final	Total	Continuous	Final	Total	
1	25851	Principles of Marketing	2	-	2	40	60	100	-	-	-	100
2	25852	Industrial Management	2	-	2	40	60	100	-	-	-	100
3	28567	Programming in C	2	3	3	40	60	100	25	25	50	150
4	26751	Generation of Electrical Power	3	3	4	60	90	150	25	25	50	200
5	26752	Electrical & Electronic Measurements-I	2	3	3	40	60	100	25	25	50	150
6	26851	Television Engineering	2	3	3	40	60	100	25	25	50	150
	26852	Electronic Appliances	-	3	1	40	60	100	--	--	--	100
	28654	Bio-Medical Instruments	2	3	3	40	60	100	25	25	50	150
<b>Total</b>			<b>15</b>	<b>18</b>	<b>21</b>	<b>340</b>	<b>510</b>	<b>850</b>	<b>125</b>	<b>125</b>	<b>250</b>	<b>1100</b>

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

<b>Rationale</b>	<p>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 fundamentals 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.</p>
<b>Learning Outcome (Theoretical)</b>	<p>After undergoing the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Describe marketing and marketing function.</li> <li>2. Distinguish between sales and marketing</li> <li>3. Interpret significance of marketing in own filed.</li> <li>4. Explore opportunities of international marketing</li> <li>5. Analyze marketing theories and marketing mix elements for product promotion.</li> <li>6. Solve the complexity arises from market environment.</li> <li>7. State classification of products marketing</li> <li>8. State distribution channels</li> <li>9. Explain implementation procedure of market segmentation, targeting and positioning strategies in product marketing.</li> <li>10. Interpret pricing tactics to get competitive advantages.</li> <li>11. Analyze branding and branding elements</li> <li>12. Explain ethical marketing and its significance</li> </ol>

## Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1	<b>INTRODUCTION TO MARKETING</b> 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 4 <sup>th</sup> industrial revolution 1.5 Discuss marketing importance on apparel industry.	4	6
2	<b>MARKETING THEORIES AND STRATEGIES</b> 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	<b>MARKET ENVIRONMENT AND INTERNATIONAL MARKETING</b> 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	<b>PRODUCT AND SERVICE MARKETING</b> 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	<b>DISTRIBUTION STRATEGIES</b> 5.1. Define distribution 5.2. State the necessity of distribution in marketing 5.3. Illustrate types of distribution channel	2	4
6	<b>SEGMENTATION, TARGETING AND POSITIONING METHODS</b> 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	<b>ESSENTIALS OF PROMOTION AND PRICING</b> 7.1 Define promotion 7.2 State fundamentals 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	<b>FUNDAMENTALS OF BRANDING</b> 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	<b>CONSUMER BEHAVIOUR</b> 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	<b>ONLINE AND ETHICAL MARKETING</b> 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
	<b>Total</b>	<b>32</b>	<b>60</b>

### **Recommended Books:**

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

2.	Marketing Management	Rajan Saxsena	Tata McGraw-Hill Education, 1 <sup>st</sup> Edition, 2005
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Subject Code	Subject Name	Period per Week		Credit
25852	INDUSTRIAL MANAGEMENT	T	P	C
		2	0	2

<b>Rationale</b>	<p>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.).</p> <p>They first need to understand the type of management and organization they work in.</p> <p>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.</p> <p>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.</p>
<b>Learning Outcome (Theoretical)</b>	<p><b>After undergoing the subject, students will be able to:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> State the roles and responsibilities of a mid-level manager within the organization</li> <li><input type="checkbox"/> Differentiate various management systems and organizations</li> <li><input type="checkbox"/> Describe the manufacturing process ensuring productivity, quality, cost and safety</li> <li><input type="checkbox"/> State the types of production planning</li> <li><input type="checkbox"/> Explain productivity improvement factors while controlling cost</li> <li><input type="checkbox"/> Describe new trends of production management systems</li> <li><input type="checkbox"/> Identify mid-level manager roles in the human resources management and development</li> <li><input type="checkbox"/> Select the suitable leadership style depending on the situations and people</li> <li><input type="checkbox"/> Identify the steps of work assignment based on goals to achieve while supporting changes</li> <li><input type="checkbox"/> Describe the steps of problem solving and decision making</li> </ul>

## DETAIL DESCRIPTION (THEORY):

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	<p><b>FUNDAMENTALS OF ORGANIZATION</b></p> <p>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.</p>	2	4
2.	<p><b>FUNDAMENTALS OF MANAGEMENT</b></p> <p>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.</p>	2	4
3.	<p><b>PRODUCTION MANAGEMENT</b></p> <p>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 &amp; 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</p>	5	8
4	<p><b>PRODUCTIVITY IMPROVEMENT</b></p> <p>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.</p>	3	6
5	<p><b>PLANNING</b></p> <p>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.</p>	4	7
6	<p><b>SUPPLY CHAIN MANAGEMENT</b></p>	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.	<b>HUMAN RESOURCES MANAGEMENT AND DEVELOPMENT (HRM-HRD)</b>  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.	<b>LEADING A TEAM</b>  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.	<b>WORK ASSIGNMENT</b>  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.	<b>PROBLEM SOLVING AND DECISION MAKING</b>  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
	<b>Total</b>	<b>32</b>	<b>60</b>

## 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.	Fast er, Bet ter, Cheaper in the History of Manufacturing 1st Edition	Christopher Roser	Productivity Press; 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 Problem Solving: 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 খালেবুজ্জামান	দি যমুনা পাবলিশার্স
16.	কলেজে আরও ভালো কীভাবে করা যায়	সম্পাদকমন্ডলী	নায়েম, ঢাকা

17.	শিল্প প্রতিষ্ঠান উৎকর্ষ অর্জন	সম্পাদকমন্ডলী	নায়েম, ঢাকা
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### **Website References:**

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

SUBJECT CODE	SUBJECT NAME	PERIOD PER WEEK		CREDIT
28567	PROGRAMMING IN C	T	P	C
		2	3	3

<b>Rationale</b>	<p>The C language is a middle-level language that is used in developing system applications and software that can be used in both high-level and low-level languages. C is a procedure oriented computer programming language which means to create lists of instructions for a computer to follow to solve specific problem or in other word to develop computer software. In this article, before starting anything about C language, first learn why to learn C (?) programming language out of these thousands programming language currently in use.</p> <p>C is a powerful general purpose computer programming language which is applicable across different platforms. Another important thing about C programming is that programs written in C are highly portable which means program written in one machine can be moved to other which is very important and powerful feature of programming language. The students should acquire knowledge, skills and attitude about C because it has won widespread acceptance and it gives programmer maximum control and efficiency.</p>
<b>Learning Outcome (Theoretical)</b>	<p><b>After undergoing the subject, students will be able to</b></p> <ul style="list-style-type: none"> <li>• State the basic structure of C program and programming style .</li> <li>• Describe algorithm and flow chart.</li> <li>• Describe data types, constants and variables.</li> <li>• Explain the operators and expressions.</li> <li>• Explain the input, output and formatted I/O operations.</li> <li>• Describe the branching and looping statements.</li> <li>• Explain the arrays, pointers and preprocessors.</li> <li>• Explain the functions, structures and union.</li> <li>• Describe file operations.</li> </ul>
<b>Learning Outcome (Practical)</b>	<p><b>After undergoing the subject, students will be able to</b></p> <ul style="list-style-type: none"> <li>• Perform to add, subtract, multiply, division and modulus among three or more numbers.</li> <li>• Perform to calculate area of a circle, triangle, sphere, ellipse, rectangle, square.</li> <li>• Perform to convert celcius to fahrenheit and vice versa, inch to centimeter and day to month to year etc.</li> <li>• Perform to solve quadratic equation.</li> <li>• Perform to find out prime numbers, fibonacci numbers, odd numbers, even numbers, factorial numbers etc.</li> <li>• Perform to add and multiply one and two dimensional matrix.</li> <li>• Perform file operation (Read, Append and Write mode).</li> <li>• Calculate a series of n numbers using branching and looping statements.</li> <li>• Find out year whether it leap year or not.</li> <li>• Perform vowels/consonants find out by using switch case statements.</li> </ul>

## DETAILED SYLLABUS (THEORY)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	<b>Fundamentals of C Programming</b> 1.1 Describe the historical development of C Programs. 1.2 Describe the basic structure of C program and programming style . 1.3 Differentiate between C and other high level languages. 1.4 Explain the process of program planning. 1.5 Describe the algorithm and flow chart. 1.6 State the compiling process of C program. 1.7 Write simple programs using basic structure of C program.	<b>03</b>	<b>06</b>
2	<b>Data types, Constants and Variables</b> 2.1 Describe the data types in C. 2.2 Explain constants and variables in C. 2.3 Describe the keywords and identifiers in C. 2.4 Mention the uses of qualifiers in data types. 2.5 State variables and assign values to variables. 2.6 State the type conversion and type definition in C. 2.7 Write simple programs using constants and variables.	<b>03</b>	<b>08</b>
3	<b>Operators and Expressions</b> 3.1 State operators and classification of operators in C Language. 3.2 Describe the arithmetic, relational, logical, assignment, increment, Decrement and conditional operators. 3.3 Explain the bitwise and special operators and their use. 3.4 Write arithmetic expression & process of evaluation in C. 3.5 Describe the precedence of arithmetic operators in C. 3.6 Mention operator precedence and associativity. 3.7 Write simple programs using operators and expressions.	<b>03</b>	<b>08</b>
4	<b>Input and Output operations</b> 4.1. Describe the statements getting input from keyboard. 4.2. Describe the statements printing output on screen and printer. 4.3 State the codes used for formatted I/O statements. 4.4 Mention the escape sequence in C. 4.5 Write programs using I/O statements.	<b>03</b>	<b>04</b>
5	<b>Branching and Looping statements</b> 5.1 Describe the conditional and unconditional branching flow statements. 5.2 State the statement for conditional and unconditional branching statements. 5.3 Explain the format for branching statements. 5.4 Describe the conditional and unconditional looping flow statements. 5.5 State the statement for conditional and unconditional looping. 5.6 Explain the format for looping statements. 5.7 Explain the use of break and continue statement. 5.8 Write programs using branching and looping statements.	<b>04</b>	<b>08</b>
6	<b>Arrays and Pointers</b> 6.1 Define arrays. 6.2 Describe the dimension of arrays. 6.3 Initialize arrays. 6.4 Write programs using arrays. 6.5 Define pointer. 6.6 Describe the characteristics of pointer. 6.7 Explain pointer expressions. 6.8 Write programs using pointers.	<b>04</b>	<b>06</b>
7	<b>Preprocessor statements in C</b> 7.1 Describe the preprocessor directives and their functions.	<b>03</b>	<b>04</b>

	<p>7.2 Define header file and list standard header files.</p> <p>7.3 Describe the process of including header file in routine.</p> <p>7.4 Explain the use of macro.</p> <p>7.5 Describe the advantage of macros over functions in programs.</p> <p>7.6 Write the programs using preprocessor statements.</p>		
<b>8</b>	<p><b>Functions</b></p> <p>8.1 Explain library function and user defined function.</p> <p>8.2 Create and call a function.</p> <p>8.3 Describe the process of calling functions and returning values from functions in C.</p> <p>8.4 Describe arguments used in functions.</p> <p>8.5 Mention the functions of prototype.</p> <p>8.6 Write programs using library function and user defined function.</p>	<b>03</b>	<b>06</b>
<b>9</b>	<p><b>Structure and Union</b></p> <p>9.1 Describe structure and union.</p> <p>9.2 Mention the structure and union declaration.</p> <p>9.3 Create and access structure members.</p> <p>9.4 Distinguish between structure and union.</p> <p>9.5 Write simple programs using structure and union.</p>	<b>03</b>	<b>05</b>
<b>10</b>	<p><b>File operations</b></p> <p>10.1 Describe file operations.</p> <p>10.2 State the modes of opening files.</p> <p>10.3 Create and read from a file.</p> <p>10.4 Write and append content to a file.</p> <p>10.5 Describe the functions that support character I/O.</p> <p>10.6 Explain the routines for performing formatted I/O to files</p> <p>10.7 Write the programs for reading, writing and editing files.</p>	<b>03</b>	<b>05</b>
	<b>Total</b>	<b>32</b>	<b>60</b>

### **DETAILED SYLLABUS (PRACTICAL)**

<b>Sl.</b>	<b>Experiment Name</b>	<b>Class (3 Period)</b>	<b>Continuous Marks</b>
<b>1</b>	<p><b>Create, compile, debug &amp; execute a C program</b></p> <p>1.1 Print a message.</p> <p>1.2 Add two integer/float numbers.</p> <p>1.3 Maintain the record of performed task.</p>	<b>1</b>	<b>3</b>
<b>2</b>	<p><b>Create, compile, debug &amp; execute a C program using constants and variables</b></p> <p>2.1 Calculate the average of N numbers.</p> <p>2.2 Convert the given temperature in Fahrenheit to Celsius and vice versa.</p> <p>2.3 Calculate the area of a circle.</p> <p>2.4 Maintain the record of performed task.</p>	<b>2</b>	<b>3</b>
<b>3</b>	<p><b>Create, compile, debug &amp; execute a C programs using operators and expressions.</b></p> <p>3.1 Convert days to month to year.</p> <p>3.2 Calculate the area of a triangle.</p> <p>3.3 Compare two integer numbers.</p> <p>3.4 Maintain the record of performed task.</p>	<b>1</b>	<b>2</b>
<b>4</b>	<p><b>Create, compile, debug &amp; execute a C program using I/O statements</b></p> <p>4.1 Read integer/real number.</p> <p>4.2 Find the sum of three floating point numbers from keyboard.</p> <p>4.3 Convert centimeter to inch using scanf () and printf () statements.</p> <p>4.4 Maintain the record of performed task.</p>	<b>1</b>	<b>3</b>

5	<b>Create, compile, debug &amp; execute a C program using Branching Statements.</b> 5.1 Select and print the largest number of three numbers. 5.2 Compute the roots of a quadratic equation. 5.4 Count vowels from a string of ten characters using switch statement. 5.4 Maintain the record of performed task.	2	3
6	<b>Create, compile, debug &amp; execute a C program using Looping Statements</b> 6.1 Print odd or even numbers from N numbers. 6.2 Find the maximum or minimum number from a set of numbers. 6.3 Check whether a number is prime or not. 6.4 Print out prime number series. 6.5 Maintain the record of performed task.	2	3
7	<b>Create, compile, debug &amp; execute a C program using arrays</b> 7.1 Sort numbers in ascending or descending order using one dimensional array. 7.2 Access the elements of array. 7.3 Add, multiply two matrix using multidimensional arrays. 7.4 Print array elements. 7.5 Maintain the record of performed task.	2	2
8	<b>Create, compile, debug &amp; execute a C program using pointers</b> 8.1 Illustrate the use of pointers in arithmetic operations. 8.2 Compute the sum of all elements stored in an array. 8.3 Maintain the record of performed task.	1	2
9	<b>Create, compile, debug &amp; execute a C program using functions</b> 9.1 Calculate the area of a factorial number. 9.2 Sort an array of integer numbers. 9.3 Calculate factorial of any integer using recursive function. 9.4 Maintain the record of performed task.	2	2
10	<b>Create, compile, debug &amp; execute a C program using structure and union.</b> 10.1 Store and retrieve data using structure. 10.2 Store and retrieve data using union. 10.3 Maintain the record of performed task.	1	2
11	<b>Create, compile, debug &amp; execute a C program using files</b> 11.1 Store/read information to/from sequential file. 11.2 Store/read information to/from random file. 11.3 Convert lower case to upper case and vice versa and store using file. 11.4 Maintain the record of performed task.	1	2
	<b>Total</b>	<b>16</b>	<b>25</b>

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

SI	Tools & Equipment's Name	Quantity
01	Core i 7 or above configuration desktop or laptop	1 no or necessary
02	Turbo C Software	1 no
03	Code::Blocks Software	1 no

### RECOMMENDED BOOKS:

SI	Book Name	Writer Name	Publisher Name & Edition
01	Programming in ANSI C	E Balagurusamy	Tata McGraw-Hill
02	Programming with C	Byron Gottfried	McGraw Hill India
03	C: The Complete Reference	Herbert Schildt	Mcgraw Hill Education

04	Object-Oriented Programming in C	Robert Lafore	Sams
05	Programming In C : A Practical Approach	Ajay Mittal	Pearson

**WEBSITE REFERENCES:**

SI	Web Link	Remarks
01	<a href="http://www.youtube.com">www.youtube.com</a>	Search here with topics
02	<a href="http://www.google.com">www.google.com</a>	Search here with topics
03	<a href="https://www.w3schools.com/c">https://www.w3schools.com/c</a>	Search directly
04	<a href="https://www.youtube.com/results?search_query=c+programming+bangla+tutorial">https://www.youtube.com/results?search_query=c+programming+bangla+tutorial</a>	Search directly

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

<b>Rationale</b>	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.
<b>Learning Outcome (Theoretical)</b>	<p>After Completing the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Outline the concept of power and energy</li> <li>2. Illustrate Renewable energy sources</li> <li>3. Interpret Boiler and Stream power plant</li> <li>4. State Diesel, Hydro-electric and Nuclear power plant</li> <li>5. Explain Gas turbine power plant</li> <li>6. Analyze Power plant economics</li> <li>7. State Wind, Wave, Tidal and Ocean thermal power generation</li> <li>8. Interpret Energy cell, Biomass and geothermal generation</li> <li>9. Describe different Authority of electrical power</li> </ol>
<b>Learning Outcome (Practical)</b>	<p>After undergoing the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Locate main power plants in Bangladesh</li> <li>2. Choose a particular power plant</li> <li>3. Inspect a boiler</li> <li>4. Operate a diesel generator</li> <li>5. Visit a steam power plant</li> <li>6. Plot load curve and load duration curve</li> <li>7. Measure voltage and current of solar panel</li> <li>8. Sketch wind power plant</li> <li>9. Measure voltage and current of fuel cells</li> <li>10. Download video clips and document of renewable energy</li> </ol>

## Detailed Syllabus (Theory)

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

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

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

	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.		
<b>13</b>	<b>BIOMASS AND GEOTHERMAL ENERGY GENERATION</b> 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.	3	4
<b>14</b>	<b>WAVE, TIDAL AND OCEAN THERMAL ENERGY</b> 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.	3	5
<b>15</b>	<b>AUTHORITY OF ELECTRICAL POWER</b> 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, NWPDCO, 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.	2	4
	<b>TOTAL</b>	<b>48</b>	<b>90</b>

### Detailed Syllabus (Practical)

SL.	EXPERIMENT NAME WITH PROCEDURE	CLASS (3 PERIOD)	CONTINUOUS MARKS
1	<p><b>LOCATE THE MAIN POWER PLANTS OF BANGLADESH WITH SOURCES OF NATURAL ENERGY BY TRACING A MAP OF BANGLADESH.</b></p> <p>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.</p>	1	2
2	<p><b>JUSTIFY A PARTICULAR POWER PLANT FOR AN AREA</b></p> <p>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.</p>	1	3
3	<p><b>INSPECT A BOILER</b></p> <p>3.1. Select an Industry where Boiler is available.  3.2. Arrange to visit and inspect the industry  3.3. Observe and Read nameplate &amp; 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.</p>	2	3
4	<p><b>OPERATE A DIESEL GENERATOR</b></p> <p>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 &amp; frequencies.  4.6. Record all readings.  4.7. Maintain the record of performed task.</p>	2	3
5	<p><b>INSPECT STEAM POWER PLANT</b></p> <p>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</p>	2	3

	temperature, type of turbine, turbine RPM, governing system, generating voltage and capacity 5.7. Maintain the record of performed task.		
6	<b>PLOT THE LOAD CURVE AND LOAD DURATION CURVE OF A POWER PLANT.</b> 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	<b>MEASURE VOLTAGE AND CURRENT FOR SERIES AND PARALLEL COMBINATION OF SOLAR PANEL.</b> 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	<b>PREPARE A NEAT INTEGRATED SKETCH OF A WIND POWER PLANT</b> 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 plant. 8.4. Identify the different sections of the plant. 8.5. Draw the layout diagram of wind power plant.	2	2
9	<b>MEASURE THE VOLTAGE OF VARIOUS FUEL CELL</b> 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	<b>DOWNLOAD AND PRESENT VIDEO CLIPS FOR DIFFERENT TYPES OF NON-CONVENTIONAL ENERGY.</b> 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
	<b>Total</b>	<b>16</b>	<b>25</b>

**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 3 <sup>rd</sup> 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 1 <sup>st</sup> 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	<a href="http://www.electricalengineering.org">http://www.electricalengineering.org</a>	
02	<a href="http://www.eetiimes.eu">http://www.eetiimes.eu</a>	
03	<a href="http://www.interestingengineering.com">http://www.interestingengineering.com</a>	

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

<b>Rationale</b>	<p>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.</p> <p>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.</p>
<b>Learning Outcome (Theoretical)</b>	<p><b>After undergoing the subject, students will acquire on</b></p> <ul style="list-style-type: none"> <li>• Explain the Concept of measurements</li> <li>• State Classification of measuring instruments</li> <li>• Describe Principle of operation of indicating instruments</li> <li>• Discuss constructional feature of measuring instruments</li> <li>• Interpret moving iron and Moving coil instruments</li> <li>• Point out Operation of wattmeter</li> <li>• Conclude Operation and testing of energy meter</li> <li>• Explain Digital instrument and digital display</li> <li>• Illustrate constructional feature of digital voltmeter and digital energy meter</li> </ul>
<b>Learning Outcome (Practical)</b>	<p><b>After undergoing the subject, students will be able to</b></p> <ol style="list-style-type: none"> <li>1. Practice the operation of indicating, integrating, recording and digital instruments.</li> <li>2. Disassemble and reassemble of ammeter and voltmeter.</li> <li>3. Study the wattmeter.</li> <li>4. Measure the single phase and three phase power.</li> <li>5. Measure the single phase and three phase energy.</li> <li>6. Test the energy meter for finding its error.</li> </ol>

## DETAILED SYLLABUS (THEORY)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	<b>CONCEPT OF MEASUREMENTS</b> 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	<b>CLASSIFICATION OF MEASURING INSTRUMENT</b> 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	<b>PRINCIPLE OF OPERATION OF INDICATING INSTRUMENTS</b> 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	<p><b>CONSTRUCTIONAL FEATURES OF MEASURING INSTRUMENTS</b></p> <p>4.1 Name the essential parts of measuring instruments.</p> <p>4.2 Mention the parts of the instrument.</p> <p>4.4 Describe supporting system, moving system, balancing, permanent magnets, pointer, scale, zero-adjuster and cases.</p> <p>4.3 Discuss the torque weight ratio.</p> <p>4.4 Explain the principle operation of ammeter and voltmeter.</p> <p>4.5 Distinguish between the working principle of ammeter and voltmeter.</p> <p>4.6 List the various types of ammeters and voltmeter.</p>	02	06
5	<p><b>MOVING IRON INSTRUMENTS</b></p> <p>5.1 Describe the construction and working principle of moving iron attraction type instruments.</p> <p>5.2 Derive the torque equation of moving iron attraction type instruments.</p> <p>5.3 Describe the construction and working principle of repulsion type moving iron instrument.</p> <p>5.4 Derive the torque equation of repulsion type moving iron instrument.</p> <p>5.5 List the advantages and disadvantages of moving iron instruments.</p> <p>5.6 Discuss errors in moving iron instruments.</p> <p>5.7 Solve the problems related to of moving iron instruments.</p>	04	06
6	<p><b>MOVING COIL INSTRUMENTS</b></p> <p>6.1 Describe the construction and working principle of permanent magnet moving coil instruments.</p> <p>6.2 Derive the torque equation of the moving coil instrument.</p> <p>6.3 Mention the advantages and disadvantages of permanent magnet moving coil instruments.</p> <p>6.4 Describe the construction and working principle of dynamometer type moving coil instruments.</p> <p>6.5 Summarize the arrangement of coils of dynamometer type instruments for measurements of current and voltage.</p> <p>6.6 Discuss the errors of moving coil instruments.</p> <p>6.7 Solve the problems related to torque equation of moving coil instruments.</p>	04	06
7	<p><b>OPERATION OF WATTMETER</b></p> <p>7.1 Describe the construction and principle of operation of dynamometer type wattmeter.</p>	03	06

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

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

### **DETAILED SYLLABUS (PRACTICAL)**

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

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

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

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

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

SI	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
09	Digital energy meter	As Necessary

**RECOMMENDED BOOKS:**

<b>SI</b>	<b>Book Name</b>	<b>Writer Name</b>	<b>Publisher Name &amp; Edition</b>
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 and Electronic 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:**

<b>SI</b>	<b>Web Link</b>	<b>Remarks</b>
01	<a href="http://www.youtube.com">www.youtube.com</a>	Search here with topics
02	<a href="http://PDFdrive.com">PDF drive .con</a>	Search here with topics
03	<a href="http://www.google.com">www.google.com</a>	Search here with topics
04	<a href="http://www.techarana360.com">www. techarana360.com</a>	Search here with topics

Subject Code	Subject Name	Period per Week		Credit
26851	<b>TELEVISION ENGINEERING</b>	T	P	C
		2	3	3

<b>Rationale</b>	Electronic devices have become an important part of our day-by-day life. Now a days it is difficult for us to live without electronic device. We live in a generation that uses electronics and smart technologies. Diploma in Engineering Level students are required to acquire the knowledge and skill on the area of Radio wave & its applications ,TV Communication System, TV Transmission & Reception, CCTV Camera ,TV Camera, Circuit Diagram of TV Receiver, LED TV Receiver ,Android SMART TV Receiver.
<b>Learning Outcome (Theoretical)</b>	<p>After Completing the subject, students will be able to :</p> <ol style="list-style-type: none"> <li>1. Interpret TV Communication System.</li> <li>2. Describe TV Transmission &amp; Reception.</li> <li>3. Illustrate CCTV Camera.</li> <li>4. State TV Camera.</li> <li>5. Explain Circuit Diagram of TV Receiver</li> <li>6. State LED TV Receiver.</li> <li>7. Explain Android SMART TV Receiver.</li> </ol>
<b>Learning Outcome (Practical)</b>	<p>After undergoing the subject, students will be able to learn:</p> <ol style="list-style-type: none"> <li>1. Operate CCTV Camera.</li> <li>2. Demonstrate TV Camera,</li> <li>3. Repair of TV Transmitter.</li> <li>4. Demonstrate LED TV Receiver,</li> <li>5. Test Android SMART TV Receiver &amp; its applications.</li> <li>6. Test finding of CRT TV Receiver.</li> <li>7. Finding Fault of LED &amp; SMART TV Receiver.</li> </ol>

## Detailed Syllabus (Theory)

Unit	Topics with contents	Class (1 Period)	Final Marks
1	<p><b>Picture &amp; TV Signal Processing</b></p> <p>1.1. Define picture signal.</p> <p>1.2. Describe the properties of Picture signal.</p> <p>1.3. Define Picture element, Gross structure, Fine structure, Image continuity and tonal gradation.</p> <p>1.4. Describe the role of TV camera, TV transmitter, propagation of signal and reception through antenna and TV receiver for TV communication.</p> <p>1.5. Describe the CCTV, MATV, CATV and satellite TV communication with applications.</p> <p>1.6. Mention the affecting factors of TV coverage.</p> <p>1.7. Describe sight propagation, earth's curvature, antenna heights and power of transmitter.</p>	3	5
2	<p><b>TV system</b></p> <p>2.1 Define Picture scanning.</p> <p>2.2 Describe scanning lines and scanning methods.</p> <p>2.3 Define field, frame, persistence of vision, flicker, picture element, aspect ratio and interlace error.</p> <p>2.4 Mention the Standard of CCIR, CCIR-B, &amp; FCC in Television system.</p> <p>2.5 Mention the frequency range, sound and picture carrier of various bands and channels in the VHF &amp; UHF range used in Bangladesh.</p>	3	4
3	<p><b>TV Camera</b></p> <p>3.1 State the principle of photoelectric conversion through camera tube.</p> <p>3.2 Classify TV Camera.</p> <p>3.3 Draw the basic Block Diagram of a TV Camera.</p> <p>3.4 Explain the principle operation of Digital camera, DSLR Camera, CCD Camera and 3-CMOS Sensor Camera,</p> <p>3.5 Describe the construction of Digital camera, DSLR Camera, CCD Camera and 3-CMOS Sensor Camera.</p> <p>3.6 State the Application of Digital camera, DSLR Camera, CCD Camera and 3-CMOS Sensor Camera.</p> <p>3.7 Explain gamma and gamma correction.</p> <p>3.8 Define image lag, sensitivity and dark current of a camera tube.</p>	3	5
4	<p><b>Composite Video Signal (CVS)</b></p> <p>4.1 Define Composite Video Signal.</p> <p>4.2 Illustrate the formation of composite video signal.</p> <p>4.3 Explain the need for sync, blanking and equalizing pulses.</p> <p>4.4 Describe the need for VSB transmission in television broadcasting.</p> <p>4.5 State the reason for employing AM for vision and FM for sound.</p> <p>4.6 Mention the reason for using negative modulation for TV</p>	3	6

	transmission.		
5	<p><b>Colour Composite Video Signal (CCVS)</b></p> <p>5.1 Define Three Colour Systems/RGB.  5.2 Define Hue, Saturation &amp; Brightness of RGB.  5.3 Describe Colour difference Signal.  5.4 Describe Luminance &amp; Chrominance Signals.  5.5 Define Colour Triangle &amp; Chromaticity Diagram.  5.6 Describe the formation of Colour Composite Video Signal.  6.7 Describe the compatibility factors in B&amp;W and Colour Transmission.</p>	3	6
6	<p><b>TV Transmitter</b></p> <p>6.1 Draw the block diagram of a standard TV transmitter.  6.2 State the Level of the signals at input and output of each block TV transmitter.  6.3 Describe the functions of each block of TV transmitter.  6.4 State standard TV Channels Characteristics &amp; TV Transmission Standards.  6.5 Describe TV Transmitter Power.</p>	3	6
7	<p><b>Monochrome and Colour TV Receiver Picture Tube</b></p> <p>7.1 Describe the construction &amp; working principle of a B &amp; W picture Tube.  7.2 Mention the functions of Monochrome and colour TV Receiver Picture Tube.  7.3 Draw the block diagram of a colour TV receiver.  7.4 Describe the functions of of a colour TV receiver.  7.5 Describe the construction &amp; working principle of a B &amp; W picture tube  7.6 Describe LCD, LED &amp; Plasma picture tube.  7.7 Illustrate the construction &amp; working principle of different type of colour picture tube.  7.8 State the Electrostatic &amp; electromagnetic Beam deflection system.  7.9 Differentiate between camera tube and picture tube.</p>	3	6
8	<p><b>Circuit diagram of TV (IC/ Transistor/Hybrid Models) Receiver.</b></p> <p>8.1 Describe the Function of Electronic Tuner.  8.2 Draw the Block Diagram of a RF Tuner (VHF &amp; UHF).  8.3 Describe the operation of Video IF &amp; Video Amplifier.  8.4 State the operation of Sound IF, FM detector &amp; Keyed AGC Circuit.  8.5 Describe the operation of Vertical &amp; Horizontal Deflection Circuit.  8.6 Interpret the operation of Fly back Transformer &amp; Generation of EHT Voltage.  8.7 Explain the operation of AFPC, Colour killer, SC oscillator, CBA, Burst blanking, colour matrix colour difference amplifier.</p>	3	6

	8.8 Describe typical faults in TV receiver circuit.		
9	<b>Digital TV System</b> 9.1 Define Digitization Principle. 9.2 Define Pixel array, Scanning notation, Viewing distance & angle, Aspect ratio, Frame rate and Refresh rate. 9.3 State Raster Scanning & Scan line waveform in DVB system. 9.4 Describe Digital Video & Audio signals. 9.5 Illustrate MAC signal, D2-MAC/ packet signal, MAC decoding & Interfacing. 9.6 Mention the Advantages of MAC signal.	2	4
10	<b>LED, Android TV, SMART TV, OLED,QLED SMART TV receiver</b> 10.1 Draw the block diagram of a LED & SMART TV receiver. 10.2 Describe the functions of LED & SMART TV receiver. 10.3 State the construction & working principle of a LED TV. 10.4 Illustrate the construction & working principle of an Android SMART TV. 10.5 Describe the construction & working principle of <b>OLED &amp; QLED</b> TV. 10.6 Mention the alignment and servicing equipment of television. 10.7 Describe trouble shooting procedure of TV receiver. 10.8 Mention the safety precautions in television servicing.	3	6
11	<b>TV Transmitting &amp; Receiving antenna and Booster</b> 11.1 State different types of TV Transmitting antenna. 11.2 Mention the procedure of installation of TV Transmitting antenna. 11.3 Mention the different types of TV Receiving antenna. 11.4 Describe the procedure of installation of Yagi antenna. 11.5 Explain the operation of Booster antenna Generator.	3	6
	<b>TOTAL</b>	<b>32</b>	<b>60</b>

### **Detailed Syllabus (Practical)**

SL. No.	Experiment name with procedure	Class (3 Period)	Continuous Marks
1	<b>Identify physical layout, location of stages and major components of a Black and White &amp; colour TV receiver</b> 1.1 Select a TV receiver and required tools & materials. 1.2 Open the TV cover and Dislock mother board circuit from body. 1.3 Identify the physical layout. 1.4 Identify the location of stages and associate	1	2

	<p>components number.</p> <p>1.5 Identify the location of major components in the physical circuit.</p> <p>1.6 Re-assemble the TV Receiver in previous condition.</p> <p>1.7 Maintain the record of performing task.</p>		
2	<p><b>Locate all controls and effect of adjustments of controls on the performance of TV receiver</b></p> <p>2.1 Select a TV receiver and required tools &amp; materials.</p> <p>2.2 Open the TV cover and Dislock mother board circuit from body.</p> <p>2.3 Find the location of different control knobs.</p> <p>2.4 Switch on the power Knob.</p> <p>2.5 Adjust each control knob.</p> <p>2.6 Monitor the effect on Sound &amp; Picture of TV receiver.</p> <p>2.7 Adjust the controls for best performance.</p> <p>2.8 Re-assemble the TV Receiver in previous condition.</p> <p>2.9 Maintain the record of performing task.</p>	1	3
3	<p><b>Test the power supply stage with typical fault conditions</b></p> <p>3.1 Select a TV receiver with required tools and materials.</p> <p>3.2 Identify the power supply stage.</p> <p>3.3 Measure voltages at test points.</p> <p>3.4 Create some faults.</p> <p>3.5 Monitor the effect.</p> <p>3.6 Remove the fault and monitor the operation.</p> <p>3.7 Maintain the record of performing task.</p>	1	3
4	<p><b>Test the CCTV Camera and associated circuits</b></p> <p>4.1 Select the CCTV Camera with required tools and materials.</p> <p>4.2 Open the CCTV Camera cover from body.</p> <p>4.3 Switch on the power supply.</p> <p>4.4 Identify the fault and make remedy.</p> <p>4.5 Maintain the record of performing task.</p>	1	3
5	<p><b>De-Assemble of LED &amp; SMART TV receiver</b></p> <p>5.1 Select a <b>LED &amp; SMART TV</b> receiver with tools and equipment.</p> <p>5.2 Open the TV cover.</p> <p>5.3 Identify the parts of <b>LED &amp; SMART TV</b>.</p> <p>5.4 Re-assemble the TV Receiver.</p> <p>5.5 Maintain the record of performing task.</p>	2	3

6	<p><b>Test the LED &amp; SMART TV and associated circuits</b></p> <p>6.1 Select the TV receiver with required tools and materials.  6.2 Open the TV cover from body.  6.3 Switch on the power supply.  6.4 Identify the fault and make remedy.  6.5 Re-assemble the TV Receiver in previous condition  6.6 Maintain the record of performing task.</p>	1	3
7	<p><b>Test the tuner stage with typical fault conditions</b></p> <p>7.1 Select a TV receiver and required tools &amp; materials.  7.2 Open the TV cover and unlock mother board circuit from body.  7.3 Switch on the power supply.  7.4 Identify the condition of Video and Audio quality.  7.5 Change tuner adjustment.  7.6 Monitor the performance.  7.7 Measure the tuner operating voltages.  7.8 Adjust the tuner for best operation.  7.9 Re-assemble the TV Receiver in previous condition.  7.10 Maintain the record of performing task.</p>	1	2
8	<p><b>Test the EHT and other high voltage section of a TV receiver</b></p> <p>8.1 Select a TV receiver with required materials and equipment.  8.2 Open the TV cover and unlock mother board circuit from body.  8.3 Switch on the power supply.  8.4 Measure the presence of high voltage.  8.5 Identify the associated circuits for high voltage.  8.6 Observe common fault and monitor the raster on TV screen.  8.7 Remove the faults.  8.8 Re-assemble the TV Receiver in previous condition.  8.9 Maintain the record of performing task.</p>	1	2
9	<p><b>Test the vision IF and detector stage with common faults</b></p> <p>9.1 Select a TV receiver with required tools and materials.  9.2 Open the TV cover and unlock mother board circuit from body.  9.3 Trace the connection of the circuit.  9.4 Switch on the power supply.  9.5 Monitor the input and output wave shapes.  9.6 Observe fault in the circuit.  9.7 Monitor the effects.  9.8 Remove the faults and monitor the result.  9.9 Re-assemble the TV Receiver in previous condition.</p>	2	2

	9.10 Maintain the record of performing task.		
10	<b>Visit a Television Factory and prepare a report</b> 10.1 Select a Television factory. 10.2 Observe the Television factory. 10.3 Prepare a report. 10.3 Prepare and present power point presentation.	1	2
	<b>Total</b>	<b>12</b>	<b>25</b>

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

SL.No.	Item Name	Quantity
01	Different types of Screw drivers, Neon tester, Standard Wire Gauge(SWG),Hammer.	Each item 25 no's
02	Ammeter, Voltmeter, Ohm meter, AVO meter,	Each item 10 no's
03	Oscilloscope	Each item 08 no's
04	Pattern Generator	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	High voltage Tester	Each item 5 no's
08	Back light LED Tester	Each item 5 no's

SL.No.	Book Name	Writer Name	Publisher Name & Edition
01	Monochrome and Color Television	R R Gulati	
02	Basic Television and Video Systems	Benrard Grob	
03	Digital Television: Technology and Standar	Jhon F. Arnold	
04	Television and Video Engineering	A M Dhake, MGH	
05	Television Engineering and Video System	R G Gupta, MGH	

### **Website References:**

SL. No.	Web Link	Remarks
01	<a href="https://www.bdshop.com/sony-bravia-xr-55a80k-55-4k-ultra-hd-tv">https://www.bdshop.com/sony-bravia-xr-55a80k-55-4k-ultra-hd-tv</a>	
02	<a href="https://www.bdstall.com/cctv-camera/">https://www.bdstall.com/cctv-camera/</a>	

Subject Code	Subject Name	Period per Week		Credit
26852	Electronic Appliances	T	P	C
		1	3	2

<b>Rationale</b>	<p>In developing nations of electronic appliances is increasing day by day. This requires large number of technically trained work force in the relevant industries. Looking toward the present need, in-depth knowledge for maintaining various electronic appliances is necessary for diploma engineering pass out students. This course will introduce the students with working principle of electronic appliances like CC camera, public addressing system, LED bulb, LED panel light, microwave oven, induction cooker and infrared cooker, washing machine, air-conditioner, refrigerator and other to develop skills to troubleshoot in systematic way. Knowledge so gained would also help in production unit's consumer gadgets or help the students to start their own enterprises. The course on electronic appliances in a diploma in engineering program is justified by the industry demand, the relevance of electronics in modern society, the need for practical skills, and the potential for innovation and career opportunities in the field. It equips students with the knowledge and skills needed to excel in a rapidly evolving and technology-driven world.</p>
<b>Learning Outcome (Theoretical)</b>	<p><b>After Completing the subject, students will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Describe installation process of the home security &amp; surveillance.</li> <li>2. Illustrate working principle of microwave oven.</li> <li>3. Interpret the induction cooker and Infrared cooker.</li> <li>4. State features of Energy Savings LED Bulb, Tube Light and Panel light.</li> <li>5. Explain the function of a washing machine.</li> <li>6. Interpret Refrigerator &amp; Air conditioner.</li> <li>7. Describe the features of office electronic appliance.</li> </ol>
<b>Learning Outcome (Practical)</b>	<p><b>After undergoing the subject, students will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Perform maintenance and servicing of close circuit-cc camera.</li> <li>2. Perform maintenance and servicing of microwave oven.</li> <li>3. Perform maintenance and servicing of induction cooker.</li> <li>4. Perform maintenance and servicing of infrared cooker.</li> <li>5. Perform maintenance and repair of energy savings (LED) bulb.</li> <li>6. Assemble LED panel light.</li> <li>7. Perform maintenance and repair of washing machine.</li> <li>8. Perform maintenance and repair of refrigerator.</li> <li>9. Perform maintenance and repair of air condition.</li> <li>10. Perform maintenance and repair of printer.</li> </ol>

## Detailed Syllabus (Theory)

Unit	Topics with contents	Class (1 Period)	Final Marks
1	<b>HOME SECURITY AND SURVEILLANCE</b> 1.1 List different types of home security & surveillance. 1.2 Describe the home security system with remote monitoring. 1.3 Draw the connection diagram of CC camera, monitor and DVR. 1.3 List the faults, causes and remedies of home security system.	2	3
2	<b>MICROWAVE OVEN</b> 2.1 State the basic principle of microwave oven. 2.2 List the parts of a microwave oven. 2.3 Sketch the block diagram of a microwave oven. 2.4 Describe the operation of a microwave oven. 2.5 Describe the function of heat control and timer of microwave oven. 2.6 List the faults, causes and remedies of microwave oven.	3	4
3	<b>INDUCTION AND INFRARED COOKER</b> 3.1 Define induction cooker, infrared cooker and rice cooker. 3.2 List the parts of an induction cooker and infrared cooker. 3.3 Describe the function of an induction cooker and infrared cooker. 3.4 Describe the operation of a rice cooker. 3.5 Mention faults, causes and remedies of induction cooker.	2	5
4	<b>ENERGY SAVINGS LED BULB</b> 4.1 Define energy savings LED bulb, tube light and panel light. 4.2 Classify LED bulb, tube light and panel light. 4.3 Differentiate between LED bulb and energy saving lamps. 4.4 Illustrate working principle of energy savings LED bulb and tube light. 4.5 Describe the operation of panel light. 4.6 Mention faults, causes and remedies of energy savings LED bulb, tube light and panel light.	3	5
5	<b>WASHING MACHINE</b> 5.1 List the parts of a washing machine. 5.2 State principle of operation of a washing machine. 5.3 Explain complete washing cycle of a washing machine. 5.4 List the faults, causes and remedies of washing machine.	2	4
6	<b>REFRIGERATOR &amp; AIR CONDITIONER</b> 6.1 State the operating principle of a refrigerator. 6.2 Sketch the refrigeration cycle. 6.3 Illustrate operating principle of air conditioner. 6.4 List faults, causes and remedies of refrigerator & air conditioner.	2	5
7	<b>OFFICE ELECTRONIC APPLIANCE</b> 7.1 State the principle of operation of photocopier machine. 7.2 Illustrate the working principle of printer. 7.3 List the control unit of scanner. 7.4 Define card reader. 7.5 Illustrate the working principle of card reader. 7.6 List the faults, causes and remedies of above appliances.	2	4

	<b>Total</b>	<b>16</b>	<b>30</b>
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### Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
1	<p><b>PERFORM MAINTENANCE AND SERVICING CLOSE CIRCUIT CAMERA</b></p> <p>1.1 Identify the different unit Close circuit-CC Camera.            1.2 Install and configure Close circuit-CC Camera.            1.3 Apply the fault-finding procedure of Close circuit-CC Camera.            1.4 Detect the faults a Close circuit-CC Camera.            1.5 Service Close circuit-CC Camera.            1.6 Maintain the record of performed task.</p>	2	2
2	<p><b>PERFORM MAINTENANCE AND SERVICING OF MICROWAVE OVEN</b></p> <p>2.1 Apply the faultfinding procedure of microwave oven.            2.2 Identify fault with causes of microwave oven            2.3 Disassemble the microwave oven.            2.4 Identify the parts of microwave oven.            2.5 Service the microwave oven.            2.6 Assemble the parts and connect the oven to the power source.            2.7 Observe the operation.            2.8 Maintain the record of performed task.</p>	2	3
3	<p><b>PERFORM MAINTENANCE AND SERVICING OF INDUCTION COOKER</b></p> <p>3.1 Apply the fault-finding procedure of induction cooker.            3.2 Identify troubles with causes of induction cooker.            3.3 Disassemble the induction cooker.            3.4 Identify the different parts of induction cooker.            3.5 Service the induction cooker.            3.6 Assemble the induction cooker and observe the operation.            3.7 Maintain the record of performing task.</p>	1	2
4	<p><b>PERFORM MAINTENANCE AND SERVICING OF INFRARED COOKER</b></p> <p>4.1 Follow the fault-finding procedure of infrared cooker.            4.2 Identify troubles with cause's infrared cooker.            4.3 Disassemble the infrared cooker.            4.4 Identify the different parts of infrared cooker.            4.5 Service the infrared cooker.            4.6 Assemble the infrared cooker and observe the operation.            4.7 Maintain the record of performed task.</p>	2	2
5	<p><b>PERFORM REPAIR AND MAINTENANCE OF ENERGY SAVINGS (LED) BULB.</b></p> <p>5.1 Disassemble the energy savings LED bulb.            5.2 Test the battery of the LED bulb.            5.3 Check the parts of energy savings LED bulb.            5.4 Repair and replace the defective parts.            5.5 Reassemble the LED bulb and connect to the power source.            5.6 Observe the charging and discharging condition.            5.7 Maintain the record of performed task.</p>	2	3

6	<b>PERFORM ASSEMBLY OF LED PANEL LIGHT.</b> 6.1 Identify the different parts of LED panel light. 6.2 Attach heat sink with PCB. 6.3 Attach heat sink, reflector, diffuser and LGB with back sheet. 6.4 Connect the power with panel light. 6.5 Test the panel Light. 6.6 Maintain the record of performed task.	1	2
7	<b>PERFORM REPAIR AND MAINTENANCE OF A WASHING MACHINE.</b> 7.1 Identify the main parts of the washing machine. 7.2 Disassemble the major components. 7.3 Make a visual observation. 7.4 Reassemble the parts. 7.5 Connect the washing machine to the power supply. 7.6 Observe the operation. 7.7 Maintain the record of performed task.	2	3
8	<b>PERFORM REPAIR AND MAINTENANCE OF A REFRIGERATOR.</b> 8.1 Identify the different parts of refrigerator. 8.2 Identify the electronic sections of refrigerator. 8.3 Follow the maintenance procedure of a refrigerator. 8.4 Disassemble and assemble the thermostat control, timer & relay. 8.5 Connect the power source. 8.6 Observe the operation. 8.7 Maintain the record of performed task.	2	3
9	<b>PERFORM REPAIR AND MAINTENANCE OF COMPONENTS OF AIR CONDITION.</b> 9.1 Identify the main parts of the air-conditioner. 9.2 Sketch the wiring diagram. 9.3 Disassemble and assemble the components of the air conditioner. 9.4 Connect the air conditioner to the power supply. 9.5 Observe the operation. 9.6 Maintain the record of performed task.	1	3
10	<b>PERFORM REPAIR AND MAINTENANCE OF A PRINTER.</b> 10.1 Observe operation of printer. 10.2 Identify the different parts of printer. 10.3 Identify electronic control unit of printer. 10.4 Follow maintenance procedure of printer. 10.5 Disassemble and assemble the printer. 10.6 Maintain the record of performed task	1	2
	<b>Total</b>	<b>16</b>	<b>25</b>

**NECESSARY RESOURCES (TOOLS, MATERIALS, EQUIPMENT'S AND MACHINERIES):**

SI	Item Name	Quantity
01	Screw drivers, Neon tester, Standard Wire gauge (SWG), hammer, mallet, soldering iron 60 watt, led, rason, crimping machine	Each item 10 no's
02	Ammeter, voltmeter, ohm meter, AVO meter, wattmeter,	Each item 10 no's

	megger	
03	Two pin socket, combined switch and socket, two pin plug.	Each item 05 no's
04	AC/ DC power supply unit	5 no's
05	LED bulb (lamp base, plastic body, driver circuit, PCB plate/heat sink, battery 12/15/18 volt, PCB & diffuser)	Each item 10 no's
06	Induction cooker, infrared cooker, washing machine air-condition, refrigerator, microwave oven	Each item 5 no's
07	CC camera, optical fiber cable, connector	Each item 5 no's
08	Monitor, DVR	Each item 2 no's

**RECOMMENDED BOOKS:**

SI	Book Name	Writer Name	Publisher Name & Edition
01	Home appliances services guide	Edwin P. Anderson	Audel Publication
02	Study of electrical appliances and devices	K.B Bhatia	
03	Electrical home appliances service manual	S. K. Gupta	Gt Publication
04	Microcontroller based home security system with remote monitoring	Nikhil Agarwal	

**WEBSITE REFERENCES:**

SI	Web Link	Remarks
01	<a href="http://www.electricalengineering.org">http://www.electricalengineering.org</a>	
02	<a href="http://www.eetiimes.eu">http://www.eetiimes.eu</a>	
03	<a href="http://www.interestingengineering.com">http://www.interestingengineering.com</a>	

	<b>SUBJECT NAME</b>	<b>PERIOD PER WEEK</b>		<b>CREDIT</b>
<b>28654</b>	<b>Biomedical Instruments</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>3</b>	<b>3</b>

<b>Rationale</b>	<p>Diploma in Engineering Level, students are required to acquire knowledge and skills of biomedical instruments such as ECG, EEG, EMG machine, measurement of blood pressure &amp; blood flow, human respiratory equipment, biochemistry analyzer, hematology analyzer, electrolyte analyzer, short wave diathermy, micro wave diathermy, phototherapy unit. electro treadmill. defibrillators, pacemaker, dialyzer. portable kidney machine. color doppler, X-ray machine, PET, SPECT, MRI, NMR, C-ARM machine, gamma camera, digital subtraction angiography, OT table, OT light, anesthesia machine, multi-parameter patient monitor, autoclave surgical diathermy unit. Some of the tasks, they perform include designing and developing biomedical instruments. They will also train other personnel on how to use biomedical instruments.</p>
<b>Learning Outcome (Theoretical)</b>	<p><b>After undergoing the subject, students will be able to</b></p> <ol style="list-style-type: none"> <li>1. Illustrate working principle of various biomedical instruments</li> <li>2. Analyze different types of biomedical signal.</li> <li>3. State the technique to measure the blood pressure &amp; blood flow.</li> <li>4. Describe procedure to operate human respiratory equipment.</li> <li>5. Describe procedure to operate medical laboratory equipment.</li> <li>6. Illustrate working principle of physiotherapy and rehabilitation devices</li> <li>7. State procedure to operate cardiac devices.</li> <li>8. State process to operate hemodialysis machine</li> <li>9. Describe procedure to operate ultrasound imaging devices</li> <li>10. Illustrate working principle of radiographic imaging system</li> <li>11. Explain procedure to operate nuclear medical imaging equipment</li> <li>12. Interpret procedure to operate OT equipment</li> </ol>
<b>Learning Outcome (Practical)</b>	<p><b>After undergoing the subject, students will be able to</b></p> <ol style="list-style-type: none"> <li>1. Identify different parts and maintenance of ECG machine.</li> <li>2. Troubleshoot and maintenance of aneroid sphygmomanometer.</li> <li>3. Troubleshoot and maintenance of Ventilator.</li> <li>4. Troubleshoot and maintenance of Hematology analyzer</li> <li>5. Install, troubleshoot and maintenance of biochemistry analyzer</li> <li>6. Identify different components and maintenance of short-wave diathermy</li> <li>7. Install, troubleshoot and maintenance of X-ray machine</li> <li>8. Identify different components and maintenance of defibrillator</li> <li>9. Troubleshoot and maintenance C-ARM machine.</li> <li>10. Troubleshoot and maintenance of anesthesia machine.</li> </ol>

## DETAILED SYLLABUS (THEORY)

Unit	Topics with Contents	Class (1 Period)	Final Marks
<b>1</b>	<p><b>Biomedical Instrumentation System</b></p> <p>1.1 Define biomedical instrumentation system.            1.2 Mention the types of Biomedical Instruments.            1.3 Describe the feature of Biomedical instrumentation system.            1.4 Describe the components of Biomedical instrumentation system.            1.5 Describe the importance of Biomedical Instrumentation.</p>	<b>1</b>	
<b>2</b>	<p><b>Biomedical Signal</b></p> <p>2.1 Define biomedical signal            2.2 Mention the biomedical signals used in medical diagnosis.            2.3 Explain waveform of electrocardiogram (ECG).            2.4 Describe the working principle of ECG machine.            2.5 State the working principle of EEG machine.            2.6 Describe the working principle of EMG machine.            2.7 State the installation procedure of ECG Machine.            2.8 Describe maintenance and repair procedure of ECG machine.</p>	<b>3</b>	
<b>3</b>	<p><b>Blood pressure &amp; blood flow</b></p> <p>3.1 Define Blood pressure, systolic &amp; diastolic.            3.2 Mention different types of the sphygmomanometer.            3.3 Describe the construction of Stethoscope.            3.4 Describe the construction and operation of aneroid sphygmomanometer.            3.5 Describe the construction and operation of digital blood pressure machine.            3.6 Explain the basic principle of magnetic blood flow meter.            3.7 Describe the operation of ultrasonic blood flow meter.</p>	<b>3</b>	
<b>4</b>	<p><b>Human respiratory equipment</b></p> <p>4.1 Define Inhalators, ventilators and respirators.            4.2 Mention different types of respiratory equipment.            4.3 Describe the construction and operation of ultrasonic nebulizer machine            4.4 Describe the construction and operation of spirometer.            4.5 Describe the stages and operating procedure of ventilator.            4.6 Mention different types of oxygen cylinders used in respiratory system.</p>	<b>3</b>	
<b>5</b>	<p><b>Medical laboratory equipment</b></p> <p>5.1 List the medical laboratory equipment.            5.2 Describe the working principle of colorimeter.            5.3 State construction and operation of biochemistry analyzer.            5.4 Describe the operation of binocular microscope.</p>	<b>3</b>	

	<p>5.5 Describe the principle of operation of hematology analyzer.</p> <p>5.6 State the operation of immunology analyzer.</p> <p>5.7 Outline the maintenance and repair procedure of hematology analyzer.</p> <p>5.8 Describe operation and maintenance of Electrolyte analyzer.</p> <p>5.9 State the basic principle of Microtome machine.</p>		
<b>6</b>	<p><b>Physiotherapy and rehabilitation devices</b></p> <p>6.1 List the Physiotherapy and Rehabilitation devices.</p> <p>6.2 Define Short wave diathermy, microwave diathermy, phototherapy, heat therapy and laser therapy.</p> <p>6.3 Describe the working principle of short-wave diathermy.</p> <p>6.4 Describe the working principle of phototherapy unit.</p> <p>6.5 Describe the construction and operation of microwave diathermy.</p> <p>6.6 Describe the basic principle of ultrasonic therapy machine.</p> <p>6.7 State the working principle of transcutaneous electrical nerve stimulator (TENS)</p>	<b>3</b>	
<b>7</b>	<p><b>Cardiac devices</b></p> <p>7.1 Define cardiac devices.</p> <p>7.2 List different types of pacemaker with application.</p> <p>7.3 Describe the operation of multiprogrammable pacemaker with block diagram.</p> <p>7.4 Describe different types of power source for implantable pacemaker.</p> <p>7.5 Define defibrillator.</p> <p>7.6 Mention the different types of defibrillators.</p> <p>7.7 Describe the construction and operation of a defibrillator with block diagram.</p>	<b>2</b>	
<b>8</b>	<p><b>Hemodialysis system</b></p> <p>8.1 Define hemodialysis system.</p> <p>8.2 Mention the types of hemodialysis system.</p> <p>8.3 Describe the hemodialysis machine with block diagram.</p> <p>8.4 Define dialyzer.</p> <p>8.5 List different types of dialyzer.</p> <p>8.6 Describe the function of portable kidney machine.</p> <p>8.7 Describe the maintenance procedure of hemodialysis machine.</p>	<b>2</b>	
<b>9</b>	<p><b>Ultrasound Imaging system</b></p> <p>9.1 Define ultrasound.</p> <p>9.2 List the ultrasound imaging devices.</p> <p>9.3 State the different types of ultra-probe.</p> <p>9.4 Define echocardiogram.</p> <p>9.5 Describe techniques to use in echocardiography.</p>	<b>3</b>	

	9.6 Mention the basic components of color doppler. 9.7 Describe the working principle of color doppler. 9.8 Describe the installation procedure of ultrasound machine		
<b>10</b>	<b>Radiographic imaging system</b> 10.1 Define Radiography, tomography, angiography and mammography. 10.2 List the radiographic imaging devices. 10.3 Describe the operation of an X-ray machine with block diagram. 10.4 Describe the operation of a digital mammography machine. 10.5 Describe the operation of computerized tomography (CT) scanner. 10.6 Describe the working principle of Magnetic Resonance Imaging (MRI) 10.7 Describe the operation of DSA (digital Subtraction Angiography) unit. 10.8 Describe working principle of C-ARM machine.	<b>3</b>	
<b>11</b>	<b>Nuclear medical imaging system</b> 11.1 List the nuclear imaging devices. 11.2 Describe the operation of Gamma camera with block diagram 11.3 Explain the principle of positron emission tomography (PET) 11.4 Describe the operation of single photon emission computerized tomography (SPECT) 11.5 Differentiate between PET and SPECT. 11.6 Explain the working principle of nuclear magnetic resonance (NMR) imaging system.	<b>3</b>	
<b>12</b>	<b>OT equipment</b> 12.1 List OT equipment. 12.2 Describe construction and operation of Hydraulic OT table. 12.3 Mention the different types of OT light with applications. 12.4 Describe the operation of suction apparatus. 12.5 Illustrate the working principle of anesthesia machine. 12.6 Describe the construction and operation of autoclave. 12.7 State the operation of multi-parameter patient monitor. 12.8 Describe the working principle of surgical diathermy unit. 12.9 Describe the construction and operation of laparoscope.	<b>3</b>	
	<b>Total</b>	<b>32</b>	<b>60</b>

### **DETAILED SYLLABUS (PRACTICAL)**

<b>Sl</b>	<b>Experiment name with procedure</b>	<b>Class (3 Period)</b>	<b>Continuous Marks</b>
<b>1</b>	<b>Identify different parts and maintenance of ECG machine</b>		

	<p>1.1 Select ECG machine.</p> <p>1.2 Identify the main components of ECG machine.</p> <p>1.3 Set up the ECG leads properly.</p> <p>1.4 Operate the machine.</p> <p>1.5 Identify problems and troubleshoot procedure.</p> <p>1.6 Maintain the record of performed task.</p>	<b>2</b>	
<b>2</b>	<p><b>Troubleshoot and maintenance of aneroid sphygmomanometer.</b></p> <p>2.1 Select aneroid sphygmomanometer (Analog BP machine)</p> <p>2.2 Identify the main components of aneroid sphygmomanometer</p> <p>2.3 Operate the aneroid sphygmomanometer.</p> <p>2.4 Identify problems and troubleshoot procedure.</p> <p>2.5 Maintain the record of performed task.</p>	<b>1</b>	
<b>3</b>	<p><b>Troubleshoot and maintenance of Ventilator.</b></p> <p>3.1 Select ventilator.</p> <p>3.2 Identify the main components of ventilator.</p> <p>3.3 Assemble all parts of ventilator.</p> <p>3.4 Operate the ventilator in test mode.</p> <p>3.5 Identify problems and troubleshoot procedure.</p> <p>3.6 Maintain the record of performed task.</p>	<b>2</b>	
<b>4</b>	<p><b>Troubleshoot and maintenance of Hematology analyzer</b></p> <p>4.1 Select hematology analyzer</p> <p>4.2 Identify the main components hematology analyzer.</p> <p>4.3 Operate the hematology analyzer.</p> <p>4.4 Identify problems and troubleshoot procedure.</p> <p>4.5 Maintain the record of performed task.</p>	<b>1</b>	
<b>5</b>	<p><b>Install, troubleshoot and maintenance of biochemistry analyzer</b></p> <p>5.1 Select biochemistry analyzer</p> <p>5.2 Identify the main components biochemistry analyzer.</p> <p>5.3 Install biochemistry analyzer.</p> <p>5.4 Identify problems and troubleshoot procedure.</p> <p>5.5 Maintain the record of performed task.</p>	<b>2</b>	
<b>6</b>	<p><b>Identify different components and maintenance of short-wave diathermy</b></p> <p>6.1 Select short wave diathermy.</p> <p>6.2 Identify the main components of short-wave diathermy.</p> <p>6.3 Operate short wave diathermy.</p> <p>6.4 Identify problems and troubleshoot procedure.</p> <p>6.5 Maintain the records of performed task.</p>	<b>1</b>	
<b>7</b>	<p><b>Installation, troubleshoot and maintenance of X-ray machine</b></p> <p>7.1 Select x-ray machine.</p> <p>7.2 Identify the main components of x-ray machine.</p> <p>7.3 Install procedure of x-ray machine</p> <p>7.4 Troubleshoot and maintenance procedure</p> <p>7.5 Maintain the records of performed task.</p>	<b>2</b>	

<b>8</b>	<b>Identify different components and maintenance of defibrillator</b> 8.1 Select defibrillator 8.2 Identify different component of defibrillator. 8.3 Operate the defibrillator machine 8.4 Troubleshoot and maintenance procedure 8.5 Maintain the records of performed task.	<b>1</b>	
<b>9</b>	<b>Troubleshoot and maintenance C-ARM machine.</b> 9.1 Select C-ARM machine. 9.2 Identify the main components of C-ARM machine. 9.3 Operate the C-ARM machine. 9.4 Troubleshoot and maintenance procedure 9.5 Maintain the records of performed task.	<b>2</b>	
<b>10</b>	<b>Troubleshoot and maintenance of anesthesia machine.</b> 10.1 Select anesthesia machine. 10.2 Identify the main components of anesthesia machine. 10.3 Assemble all accessories of anesthesia machine. 10.4 Operate the anesthesia machine. 10.5 Troubleshoot the anesthesia 10.6 Maintain the record of performed task.	<b>2</b>	
	<b>Total</b>	<b>16</b>	<b>25</b>

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

<b>SI</b>	<b>Item Name</b>	<b>Quantity</b>
01	ECG machine	Each item 02 no's
02	Aneroid sphygmomanometer( Analog BP machine)	Each item 05 no's
03	Ventilator.	Each item 02no's
04	Hematology analyzer	Each item 02 no's
05	Biochemistry analyzer	Each item 02 no's
06	Short-wave diathermy	Each item 02 no's
07	X-ray machine	Each item 01 no's
08	Defibrillator	Each item 02 no's
09	C-ARM machine.	Each item 01 no's
10	Anesthesia machine	Each item 02 no's

**RECOMMENDED BOOKS:**

<b>SI</b>	<b>Book Name</b>	<b>Writer Name</b>	<b>Publisher Name &amp; Edition</b>
01	Handbook of Biomedical Instrumentation	R. S. Khandpur	S.Chand, Millenium Edition
02	Handbook of Analytical Instruments	R. S. Khandpur	2nd edition
03	The Physics of Radiology	J. R. Cunningham	2021` edition
04	Physics of Medical Imaging	Steve Webb	Katson books
05	Diagnostic Ultrasonography	W. N. Diken	Mc Grew Hill international, Fourth Edition.
06	NMRI Principles	Stuart W. Yong.	

**Website References:**

<b>Sl</b>	<b>Web Link</b>	<b>Remarks</b>
01	<a href="https://youtu.be/hTz_rGP4v9Y?t=1">https://youtu.be/hTz_rGP4v9Y?t=1</a>	
02	<a href="https://youtu.be/C35Lq2vntzU?t=2">https://youtu.be/C35Lq2vntzU?t=2</a>	
03	<a href="https://youtu.be/4PnHHVBFdke?t=6">https://youtu.be/4PnHHVBFdke?t=6</a>	
04	<a href="https://youtu.be/YhBSkfrCrWA?t=8">https://youtu.be/YhBSkfrCrWA?t=8</a>	
05	<a href="https://youtu.be/IN_WyRY-UBQ?t=6">https://youtu.be/IN_WyRY-UBQ?t=6</a>	
06	<a href="https://youtu.be/vsSfUisVD9k?t=14">https://youtu.be/vsSfUisVD9k?t=14</a>	