



**BANGLADESH TECHNICAL EDUCATION BOARD**

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

**Dhaka-1207.**

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

**POWER TECHNOLOGY**

**TECHNOLOGY CODE: 71**

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

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

# DIPLOMA IN ENGINEERING CURRICULUM COURSE STRUCTURE

(PROBIDHAN-2022)

**TECHNOLOGY NAME: POWER TECHNOLOGY (71)**

(5<sup>th</sup> SEMESTER)

Sl. No.	Subject		Period Per Week		Credit	Marks Distribution						Grand Total
						Theory Assessment			Practical Assessment			
	Code	Name	Theory	Practical		Continuous	Final	Total	Continuous	Final	Total	
1	25831	Business Communication	2	-	2	40	60	100	-	-	-	100
2	25852	Industrial Management	2	-	2	40	60	100	-	-	-	100
3	26241	Automotive Body Building	2	3	3	40	60	100	25	25	50	150
4	27051	Fluid Mechanics & Machineries	3	3	4	60	90	150	25	25	50	200
5	27053	Advanced Welding-I	2	6	4	40	60	100	50	50	100	200
6	27151	Automotive Electricity, Electronics & Automation	2	3	3	40	60	100	25	25	50	150
	27152	Power Plant Engineering	2	3	3	40	60	100	25	25	50	150
<b>Total</b>			<b>15</b>	<b>18</b>	<b>21</b>	<b>300</b>	<b>450</b>	<b>750</b>	<b>150</b>	<b>150</b>	<b>300</b>	<b>1050</b>

Subject Code	Subject Name	Period per Week		Credit
25841	Business Communication	T	P	C
		2	0	2

<b>Rationale</b>	<p>Business communication plays a vital role in modern time. Business communication the process of sharing information between employees within and outside a company. Business communication is essential for success and growth of every organization. By studying this course students will be able to acquire knowledge on communication, Communication model and feedback, Types of communication, Formal and informal communication, Report writing, Methods of communication, effective listening, Essentials of communication, Office management and developed skills on delivered effective presentation, interpersonal communication, listening, report writing and business letter.</p>
<b>Learning Outcome</b>	<p><b>After completion of this course, students will be able to</b></p> <ul style="list-style-type: none"> <li>• Effective business communication.</li> <li>• Developing and delivering effective presentations.</li> <li>• Effective interpersonal communications.</li> <li>• Good time management.</li> <li>• Effective problem solving.</li> <li>• Acquiring Knowledge of Information and Communication Technology.</li> <li>• Effective business report writing.</li> </ul>

## Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	<p><b>Business communication.</b></p> <p>1.1 Define business.            1.2 Define communication.            1.3 Define business communication.            1.4 Describe the scope of business communication.            1.5 Mention the Importance of communication in modern business.            1.6 State the objectives of business communication.            1.7 State the functions of business communication.            1.8 Discuss the principles of communication.            1.9 Mention the essential elements of communication process.</p>	<b>4</b>	<b>8</b>
2.	<p><b>Communication model and feedback.</b></p> <p>2.1 Define communication model.            2.2 State the Importance of communication model.            2.3 State the basic functions of Communication model.            2.4 Mention the Limitation of communication model.            2.5 Define feedback.            2.6 State the basic principles of effective feedback.            2.7 State the essential feedback to complete communication process.</p>	<b>3</b>	<b>6</b>
3.	<p><b>Types of communication.</b></p> <p>3.1 Define channel of communication.            3.2 Mention the channel of communication.            3.3 State the different types of communication.            3.4 Distinguish between upward and downward communication.            3.5 State the merits and demerits of upward communication.            3.6 State the merits and demerits of downward communication.            3.7 Define two-way communication.            3.8 Explain- `Two-way communication is more important now a day.            3.9 State the merits and demerits of two-way communication.</p>	<b>5</b>	<b>9</b>
4.	<p><b>Formal and informal communication.</b></p> <p>4.1 Define the formal and informal communication.            4.2 Describe the advantages and disadvantages of formal communication.            4.3 Describe the advantages and disadvantages of informal communication.            4.4 Difference between formal and informal communication.</p>	<b>2</b>	<b>4</b>

5.	<b>Methods of communication.</b> 5.1 Define communication methods. 5.2 Discuss the various methods of communication. 5.3 Discuss the merits and demerits of oral communication. 5.4 Discuss the merits and demerits of written communication. 5.5 Difference between oral and written communication.	3	6
6.	<b>Effective listening</b> 6.1 Define listening. 6.2 State the different types of listening. 6.3 State the importance of listening. 6.4 Define effective listening. 6.5 Discuss the barriers to effective listening. 6.6 Discuss the way for overcoming barriers to effective listening.	3	5
7.	<b>Essentials of communication</b> 7.1 Discuss the essential qualities of good communication. 7.2 Discuss the barriers of communication. 7.3 Discuss the way for overcoming barriers to good communication.	2	4
8.	<b>Report writing</b> 8.1 Define report, business report and technical report. 8.2 State the essential features of a good report. 8.3 Mention the factors to be considered while drafting a report. 8.4 State the components of technical report. 8.5 Distinguish between a technical report and general report. 8.6 Prepare a technical report.	4	7
9.	<b>Office management.</b> 9.1 Define office and office work. 9.2 State the characteristics of office work. 9.3 Define filing and indexing. 9.4 Discusses the method of filing. 9.5 Discusses the method of indexing. 9.6 Distinguish between filing and indexing.	3	5
10.	<b>Business letter, official and semiofficial letters.</b> 10.1 Define then business letter, official and semiofficial letters. 10.2 State the Importance of business letter. 10.3 Prepare Curriculum vitae (CV), Appointment letter, joining letter, leave letter, Complain Letter and tender notice.	3	6
	<b>Total</b>	<b>32</b>	<b>60</b>

#### REFERENCE BOOK:

1. Business Communication and Report Writing-Professor Murtaza Ali
2. Business Communication-মো: খালেকুজ্জামান ও মো: মোশারফ হোসেন চৌধুরী

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. 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
	<p>6.1 Define supply chain management.</p> <p>6.2 Explain the components of supply chain management.</p> <p>6.3 Explain production integration into supply chain management.</p>		
7.	<p><b>HUMAN RESOURCES MANAGEMENT AND DEVELOPMENT (HRM-HRD)</b></p> <p>7.1 Describe the main functions in human resources management (HRM).</p> <p>7.2 Describe the main functions in human resources development (HRD).</p> <p>7.3 Explain the role of manager in the recruitment process.</p> <p>7.4 Explain the role of manager in the training process.</p> <p>7.5 Explain the role of manager in the performance management system.</p> <p>7.6 Mention the components of compensation and benefits system.</p>	3	6
8.	<p><b>LEADING A TEAM</b></p> <p>8.1 Define leadership.</p> <p>8.2 Identify personality traits impacting leadership style.</p> <p>8.3 Discuss the types of leadership.</p> <p>8.4 Define motivation and motivational cycle.</p> <p>8.5 State the importance of motivation.</p> <p>8.6 List motivation drivers based on Maslow, Herzberg adapted to various generations</p> <p>8.7 State concepts of Theory-X, Theory-Y and Theory-Z</p>	3	6
9.	<p><b>WORK ASSIGNMENT</b></p> <p>9.1 List different types of leadership styles.</p> <p>9.2 Describe the leadership style adapted to the work assignment and delegation.</p> <p>9.3 State SMART goal.</p> <p>9.4 Set SMART goals to support work assignment.</p> <p>9.5 Identify ways to reduce resistance to change during work assignment.</p>	4	8
10.	<p><b>PROBLEM SOLVING AND DECISION MAKING</b></p> <p>10.1 Mention the steps of problem solving.</p> <p>10.2 Explain tools used to analyze and solve problem addressing the 5M components.</p> <p>10.3 Define decision making.</p> <p>10.4 Discuss different types of decision-making process.</p> <p>10.5 Describe the steps in decision making.</p>	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	McGrawHill; 2nd edition (March 22, 2015)
05.	The Toyota Way, Second Edition: 14 Management Principles from the World's Greatest Manufacturer Hardcover	Jeffrey K Liker	McGrawHill; 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
26241	AUTOMOTIVE BODYBUILDING	T	P	C
		2	3	3

<b>Rationale</b>	Automotive bodybuilding deals with the design of vehicles with the kinetic force and efficiency of the fuel of the automobile. Through this course, students have an opportunity to acquire knowledge, skill and practical application in the field of automobile technologies with special emphasis on body repair, chassis realigning, Painting booth operation, and safety precautions to make a complete vehicle, that consists of doors, windows, engine covers, roof, luggage cover etc. Different type of body is attached to the chassis according to the application.
<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 construction of the automobile body and chassis</li> <li>• State the Collision of the automobile body</li> <li>• List of the tools and equipment required for collision damage works and repairing</li> <li>• Mention the fasteners assembly</li> <li>• Describe the automobile body construction</li> <li>• Describe the operations and maintenance of tools and equipment</li> <li>• Describe different types of welding and soldering process</li> <li>• Describe collision repair systems</li> <li>• Describe the automobile body painting.</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>• Identify tools and equipment required for auto-body repair</li> <li>• Apply fasteners &amp; Sheet metal damage repair</li> <li>• Perform Arc welding, spot welding and MIG welding</li> <li>• Perform welding process &amp; fitting methods</li> <li>• Perform the surface preparation and features of primer</li> <li>• Identify different parts of the body</li> <li>• Demonstrate opening refitting of automobile glasses.</li> <li>• Perform the Refinishing methods and spray-painting equipment.</li> </ul>

## DETAILED SYLLABUS (THEORY)

Unit	Topics with Contents	Class (2 Period)	Final Marks
<b>1.</b>	<b>FEATURES AND CONSTRUCTION OF AUTOMOBILE BODY</b> 1.1 Define automobile body. 1.2 Mention the function of an automobile body. 1.3 Name the various designs of the automobile body with a sketch. 1.4 Mention the major body panels of a car with sketch. 1.5 Explain the automobile body, frame and unibody construction. 1.6 Describe the manufacturing method of an automobile body. 1.7 Explain the effects of overhangs. 1.8 List the required materials for automobile body making.	<b>03</b>	<b>06</b>
<b>2</b>	<b>AUTOMOBILE FRAME</b> 2.1 Define automobile frame. 2.2 List the different types of frames used in automobiles. 2.3 Explain the forming of a metal frame to provide strength crown, angles and flanges, u-channels and box section rail pillars. 2.4 Explain stamping body parts.	<b>02</b>	<b>04</b>
<b>3</b>	<b>COLLISION OF THE AUTOMOBILE BODY</b> 3.1 Mention the effects of the collision of the automobile body. 3.2 Define metal bumping & dinging, buckle & roll of sheet metal. 3.3 Explain the low and high spot damage of the body. 3.4 Mention the uses of fittings, denting, straightening and alignment of an automobile body. 3.5 Prepare an estimation of the damaged body repair cost.	<b>03</b>	<b>06</b>
<b>4</b>	<b>TOOLS AND EQUIPMENT OF COLLISION DAMAGE WORK</b> 4.1 Mention the hand tools for collision work. 4.2 List the necessary hand bumping tools for automobile body repair. 4.3 Mention the function of Hammer, Dolly blocks & Spoons 4.4 Mention the function of Files and Files holders, Hydraulic jacks 4.5 Mention the function of Rapid Denter 4.6 Mention the function of the Plastic stapler kit 4.7 Mention the function of the Universal welding station, Arc, MIG & spot welding 4.8 Mention the function of the Infra-red dryer 4.9 Mention the function of the Painting booth 4.10 Mention the function of Water Borne Paint dryer	<b>04</b>	<b>06</b>
<b>5</b>	<b>FASTENERS ASSEMBLY OF THE AUTOMOBILE BODY</b> 5.1 Mention the uses of bolts, cap screw, carriage bolt, bumper bolt, studs and machine bolt and stove bolt. 5.2 Mention the uses of different types of nuts used with the various fasteners. 5.3 Mention the use of different types of clips and washers.	<b>02</b>	<b>04</b>
<b>6</b>	<b>SHEET METAL DAMAGE REPAIRING</b> 6.1 Mention the considering factors to determine the types of damage.	<b>03</b>	<b>04</b>

	<p>6.2 Explain the methods of choosing the right type of hammer.</p> <p>6.3 Explain the principle of using the hammer of dolly method.</p> <p>6.4 Describe the method of detecting high and low spots.</p> <p>6.5 Describe the process of picking up the low spots.</p> <p>6.6 Mention the basic uses of the disc grinder.</p> <p>6.7 Describe the repairing procedure for the damage by using mechanical and hydraulic body jacks.</p> <p>6.8 Describe the repairing procedure of crowned panel.</p>		
<b>7</b>	<p><b>WELDING PROCESSES AND THEIR APPLICATION</b></p> <p>7.1 Define gas, arc and spot welding.</p> <p>7.2 Explain the different types of gas flame with uses.</p> <p>7.3 State different types of welding positions and various types of welding joints with sketches.</p> <p>7.4 Describe the process of sheet metal welding.</p> <p>7.5 Describe the process of striking arc welding.</p> <p>7.6 Describe the process of running beat.</p> <p>7.7 State the safety Precautions of welding equipment in automobiles.</p> <p>7.8 Mention the uses of spot welding.</p> <p>7.9 Compare among soldering, brazing &amp; welding.</p>	<b>04</b>	<b>08</b>
<b>8</b>	<p><b>DECKLID, HOOD AND DOOR FITTING METHOD AND SURFACE PREPARATION</b></p> <p>8.1 Describe the process of deck lid fitting.</p> <p>8.2 Describe the process of hood fitting.</p> <p>8.3 Describe the process of door fitting.</p> <p>8.4 Describe the process of correcting a misaligned door.</p> <p>8.5 Describe the frame straightening methods.</p> <p>8.6 State surface preparation.</p> <p>8.7 Mention the purposes of surface preparation.</p> <p>8.8 Describe the steps of surface preparation.</p> <p>8.9 Mention the uses of putties and sealers.</p> <p>8.10 Describe the methods of surface preparation using abrasive paper sending operation.</p>	<b>03</b>	<b>06</b>
<b>9</b>	<p><b>REFINISHING METHOD</b></p> <p>9.1 Mention the importance of painting.</p> <p>9.2 List the basic ingredients of painting.</p> <p>9.3 Mention the uses of pigment, binder &amp; solvent.</p> <p>9.4 Mention the uses of top coat, undercoat and guide coat.</p> <p>9.5 Describe the application method of synthetic enamel and lacquers.</p> <p>9.6 Explain the uses of thinners and reducers.</p> <p>9.7 Describe the manual painting process.</p> <p>9.8 List the steps of painting an automobile body.</p> <p>9.9 List the safety precaution in the paint shop.</p>	<b>04</b>	<b>08</b>
<b>10</b>	<p><b>SPRAY PAINTING EQUIPMENT</b></p> <p>10.1 Describe different types of spray gun.</p> <p>10.2 Mention the principal parts of a spray gun.</p> <p>10.3 State the operating principle of the spray gun.</p> <p>10.4 Explain the painting booth operation and maintenance.</p> <p>10.5 Describe different types of painting booth</p> <p>10.6 Mention different parts of the painting booth</p> <p>10.7 Define Waterborne paint dryer</p>	<b>04</b>	<b>08</b>

	10.8 Describe the different types of waterborne paint dryers.		
	10.9 Mention different parts of waterborne paint dryer		
	<b>Total</b>	<b>32</b>	<b>60</b>

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

Sl.	Experiment Name	Class (3 Period)	Marks (Continuous)
<b>1</b>	<b>Identify automobile body parts</b> 1.1 Identify the panels and crown 1.2 Identify the floor panel assembly and front cowl assembly 1.3 Identify the quarter panel, roof assembly and front-end assembly 1.4 Identify the front structure (bumper and hood) 1.5 Identify door glass, interior hardware and trim 1.6 Identify different types of seats of automobiles 1.7 Identify glass and windshield and rear window glass mountings 1.8 Maintain the record of the performed task	<b>2</b>	<b>2</b>
<b>2</b>	<b>Identify Hand tools of body bumping &amp; fasteners of the automobile</b> 2.1 Identify the bumping, dinging and pick hammers 2.2 Identify dollies, spoons, pry bars, body files, and file holders and reveal the file handle and file blade set 2.3 Identify bolts, cap screws, carriage bolts, bumper bolts, studs machine bolts and stove bolts 2.4 Identify the common types of nuts used with the fasteners 2.5 Identify the labeler types of speed clips and metal screws 2.6 Practice selecting bolt and screw sizes, and head and nut sizes 2.7 Identify the washers and hollow rivets 2.8 Identify the different types of rivets 2.9 Practice riveting to build up an automobile body 2.10 Maintain the record of the performed task	<b>2</b>	<b>4</b>
<b>3</b>	<b>Perform oxy-acetylene welding</b> 3.1 Identify the components of oxy-acetylene welding equipment 3.2 Turn the welding units 3.3 Perform lighting the welding torch and prepare the three types of flame 3.4 Shut off the flame. 3.5 Practice the welding work on various welding positions; flat; vertical; overhead and horizontal 3.6 Practice welding sheet metal 3.7 Practice brazes welding in a vertical and horizontal position 3.8 Practice oxygen cutting by cutting attachments 3.9 Practice cutting plates and cutting sheet metal 3.10 Maintain the record of the performed task	<b>2</b>	<b>4</b>
<b>4</b>	<b>Perform electric arc welding</b>	<b>1</b>	<b>2</b>

	<p>4.1 Identify the components of electric arc equipment.</p> <p>4.2 Select the electrodes and their sizes.</p> <p>4.3 Set the current of the machine.</p> <p>4.4 Practice striking the Arc.</p> <p>4.5 Practice running a beat.</p> <p>4.6 Practice welding in various positions.</p>		
<b>5</b>	<p><b>Perform the sheet metal damage repair</b></p> <p>5.1 Apply hammering techniques</p> <p>5.2 Practice denting with hammer and dolly</p> <p>5.3 Apply basic hammer and dolly methods in straightening the damaged area</p> <p>5.4 Apply techniques of body filing cross and x filing</p> <p>5.5 Practice picking up low spots</p> <p>5.6 Practice using a disc sander or grinder to remove paint and to provide the scratch pattern</p> <p>5.7 Maintain the record of the performed task</p>	<b>2</b>	<b>3</b>
<b>6</b>	<p><b>Perform straightening typical damage</b></p> <p>6.1 Select hinge buckle, roll buckle, direct damage and indirect damage</p> <p>6.2 Practice straightening damage by using jacks</p> <p>6.3 Practice straightening metal without damaging the point</p> <p>6.4 Practice repairing a double high crowned area</p> <p>6.5 Practice repairing a low crowned area</p> <p>6.6 Practice in straightening a reverse crowned area</p> <p>6.7 Maintain the record of the performed task</p>	<b>1</b>	<b>2</b>
<b>7</b>	<p><b>Perform soldering</b></p> <p>7.1 Identify the components of the soldering unit</p> <p>7.2 Practice the process of using solder</p> <p>7.3 Apply the solder filling techniques</p> <p>7.4 Show tinning steps for using tinning flux</p> <p>7.5 Practice the application of soldering puddles</p> <p>7.6 Practice the soldering on the surface</p> <p>7.7 Maintain the record of the performed task</p>	<b>1</b>	<b>2</b>
<b>8</b>	<p><b>Practice fitting methods</b></p> <p>8.1 Remove &amp; replace the radiator</p> <p>8.2 Adjust front &amp; rear bumper</p> <p>8.3 Remove &amp; fixing the front windshield and window glass</p> <p>8.4 Practice door fitting, raising and lowering the door, forward and backward adjustment, misaligned door correction, and adjustment of door locks</p> <p>8.5 Maintain the record of the performed task</p>	<b>1</b>	<b>2</b>
<b>9</b>	<p><b>Perform refinishing and surface preparation</b></p> <p>9.1 Identify the pigment binder and solvent</p> <p>9.2 Practice the top coats and undercoats</p> <p>9.3 Apply synthetic enamel, lacquers, metallic top coats, primary putties, sealers and reducers</p> <p>9.4 Apply wax and grease removers</p> <p>9.5 Apply polisher application and metal conditioner</p>	<b>2</b>	<b>2</b>

	9.6 Practice the abrasive papers 9.7 Perform edging, block sanding and masking 9.8 Perform the refinishing procedure 9.9 Maintain the record of the performed task		
<b>10</b>	<b>Apply spray equipment</b> 10.1 Identify the principal parts of a spray gun 10.2 Adjust the spray gun 10.3 Operate the spray gun 10.4 Required the air pressure in using the spray gun 10.5 Keep the proper distance from the work and the technique of the triggering gun 10.6 Practice spray 10.7 Practice waxing, polishing and clearing of the exterior of the automobile 10.8 Practice interior cleaning of the vehicle 10.9 Maintain the record of the performed task	<b>2</b>	<b>2</b>
	Total	<b>16</b>	<b>25</b>

### **NECESSARY RESOURCES (TOOLS, EQUIPMENTS AND MACHINERY):**

<b>SI</b>	<b>Item Name</b>	<b>Quantity</b>
01	Hammer, Dolly blocks, Spoons, Files and Files holders	As Necessary
02	Rapid Denter	As Necessary
03	Plastic stapler kit	As Necessary
04	Universal welding station	As Necessary
05	Arc welding Machine	As Necessary
06	MIG Welding Machine	As Necessary
07	Spot welding Mach	As Necessary
08	Infra-red dryer	As Necessary
09	Flatliner	As Necessary

### **RECOMMENDED BOOKS:**

<b>SI</b>	<b>Book Name</b>	<b>Writer Name</b>	<b>Publisher Name &amp; Edition</b>
01	Auto Body Repairing and Repainting	- Bill Tobledt.	Khanna Publications
02	Automotive Body Repair and Refinishing	- W. H Crouse and D. L Anglin.	Khanna Publications
03	Automobile Engineering	- J.B.S. Narang.	Khanna Publications

### **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="https://www.youtube.com/watch?v=-Y-WedpjlB0">https://www.youtube.com/watch?v=-Y-WedpjlB0</a>	Click the link
03	<a href="https://www.youtube.com/watch?v=qOfBcMnd8_E">https://www.youtube.com/watch?v=qOfBcMnd8_E</a>	Click the link
04	<a href="https://www.youtube.com/watch?v=HIGjCkeU3Tk">https://www.youtube.com/watch?v=HIGjCkeU3Tk</a>	Click the link



SUBJECT CODE	SUBJECT NAME	PERIOD PER WEEK		CREDIT
		T	P	
27051	FLUID MECHANICS & MACHINERY	3	3	4

<b>Rationale</b>	<p>Fluid mechanics deals with the study of all fluids under static and dynamic situations. This is a branch of continuous mechanics that deals with a relationship between forces, motions, and static conditions. Studying fluid mechanics and machinery in mechanical engineering is to gain the knowledge and tools necessary to analyze, design and optimize systems where fluids are a key component. By understanding fluid behavior, diploma engineers can improve energy efficiency, enhance performance and ensure the safety and reliability of engineering systems.</p> <p>This course will introduce the students with fluid, fluid properties and unit conversion, pressure gauges, Bernoulli's theorem, fluid flow through orifice and mouthpiece, operation of water turbine, reciprocating pump and centrifugal pump, Pascal's law, working procedure of hydraulic devices, hydraulic and pneumatic system. The students should acquire knowledge, skills and attitude regarding fluid mechanics and machinery, hydraulics, and pneumatic system.</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. State fluid, fluid properties with unit conversion.</li> <li>2. Illustrate different types of pressure gauges.</li> <li>3. Illustrate fluid flow through pipe.</li> <li>4. Explain Bernoulli's theorem.</li> <li>5. Describe fluid flow through orifice and mouthpiece.</li> <li>6. Interpret viscous flow and impact of jet.</li> <li>7. Explain friction losses in pipe.</li> <li>8. Explain the operation of water turbine, reciprocating pump and centrifugal pump.</li> <li>9. State Pascal's law with applications.</li> <li>10. Describe the working procedure of hydraulic devices.</li> <li>11. Explain the process of hydraulic and pneumatic system.</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. Calibrate a bourdon tube pressure gauge with a dead weight gauge.</li> <li>2. Verify Bernoulli's equation by Bernoulli's apparatus equipped with a hydraulic test bench.</li> <li>3. Determine the discharge of water through a pipe by the venturi meter or orifice meter equipped with a hydraulic test bench.</li> <li>4. Determine the loss of head due to friction by fluid friction apparatus.</li> <li>5. Test the performance of a reciprocating pump with the reciprocating pump test rig.</li> <li>6. Test the performance of a centrifugal pump with the centrifugal pump test rig.</li> <li>7. Test the performance of an impulse turbine with the impulse (Pelton wheel) turbine test rig.</li> <li>8. Determine the leverage and mechanical advantage of a hydraulic press.</li> <li>9. Identify the different components of a two-stage reciprocating air compressor and operate the compressor.</li> <li>10. Perform automatic operation of the double-acting cylinder in a single cycle using the limit switch.</li> </ol>

## DETAILED SYLLABUS (THEORY)

Unit.	Topics with Contents	Class (1Period)	Final Marks
1.	<b>INTRODUCTION TO FLUID</b> 1.1 Define fluid. 1.2 Classify fluid. 1.3 Compare among liquid, vapor, and gas. 1.4 Define hydraulics and hydraulic machinery. 1.5 Outline the importance of hydraulics and hydraulic machinery. 1.6 State the branches of hydraulics. 1.7 Mention the applications of hydraulics and hydraulic machinery in the engineering field.	02	04
2.	<b>FLUID PROPERTIES</b> 2.1 List the properties of fluids. 2.2 Define density, specific weight, surface tension, capillary, viscosity, and fluid pressure. 2.3 Define atmospheric pressure, gauge pressure, and absolute pressure. 2.4 Relate among atmospheric pressure, gauge pressure, and absolute pressure. 2.5 Derive the formulae to find total pressure on the immersed surface at horizontal, inclined, and vertical positions. 2.6 Solve the problems on static fluid pressure.	03	05
3.	<b>FLUID PRESSURE GAUGES</b> 3.1 Define pressure gauge. 3.2 State the different types of pressure gauges. 3.3 Distinguish between simple manometer and differential manometer. 3.4 Describe the working principle of different types of pressure gauges. 3.5 Mention the application of different pressure gauges. 3.6 Solve the problems related to the measurement of fluid pressure.	04	07
4.	<b>FLUID FLOWS THROUGH PIPES</b> 4.1 State different types of fluid flow. 4.2 State continuity equation of flow. 4.3 Define flow rate. 4.4 Derive the formula of flow rate. 4.5 Solve the problems on continuity equation of flow.	03	06
5.	<b>BERNOULLI'S EQUATION</b> 5.1 Define head, pressure head, velocity head, datum head, and total head. 5.2 State Bernoulli's equation of fluid. 5.3 Derive Bernoulli's equation of fluid. 5.4 Outline the application of Bernoulli's equation of fluid. 5.5 Point out the limitation of Bernoulli's equation. 5.6 Mention the function of the venture meter, orifice meter and pitot tube. 5.7 Describe the operation of venture meter, orifice meter and pitot tube. 5.8 Derive the formula to measure the discharge of fluid flow through the venture-meter. 5.9 Drive the formula to measure the discharge of fluid flow through the orifice-meter and the pitot tube. 5.10 Solve the problems on fluid flow through a pipe, Bernoulli's equation, venture-meter, orifice-meter and pitot tube.	05	08

6.	<p><b>FLOW THROUGH ORIFICES</b></p> <p>6.1 Define orifice.  6.2 Classify orifice.  6.3 State hydraulic coefficients.  6.4 Define jet of water, vena-contracta, coefficient of contraction (<math>C_c</math>), coefficient of velocity (<math>C_v</math>), coefficient of discharge (<math>C_d</math>), and coefficient of resistance.  6.5 Relate <math>C_c</math>, <math>C_v</math>, and <math>C_d</math>.  6.6 Calculate different hydraulic coefficient.  6.7 Solve the problems related to orifice.</p>	03	06
7.	<p><b>FLOW THROUGH MOUTHPIECES</b></p> <p>7.1 Define mouthpieces.  7.2 Classify mouthpieces.  7.3 Deduce the formulae to calculate discharge of fluid flow through different types of mouthpieces.  7.4 State head losses of flowing liquid in a pipe.  7.5 List the causes of head loss of liquid flow.  7.6 Deduce the formulae to calculate the head loss due to friction, sudden enlargement, sudden contraction and obstruction in the pipe.  7.7 Deduce the formulae to calculate the head loss due to friction (Darcy's and Cheay's formulae).  7.8 Solve the problems related to head losses and discharge of fluid flow through mouthpieces.</p>	04	06
8.	<p><b>VISCOUS FLOW</b></p> <p>8.1 Define viscosity.  8.2 Mention the units of viscosity.  8.3 Define ideal fluid, real fluid, Newtonian fluid and non-Newtonian fluid.  8.4 Distinguish between the laminar flow and turbulent flow.  8.5 State Reynold's number.  8.6 Solve the problems related to viscosity.</p>	02	04
9.	<p><b>THE IMPACT OF THE JETS</b></p> <p>9.1 Define Jet.  9.2 State the impact of jet.  9.3 Deduce the formula to calculate the force of a jet impinging on a flat fixed verticalplate, inclined plate, and hinged plate.  9.3 Solve the problems on the impact of jets related to flat fixed plates, inclined fixed plates, and hingedplates.</p>	03	05
10.	<p><b>WATER TURBINES</b></p> <p>10.1 State water turbine.  10.2 Classify water turbine.  10.3 Illustrate the principle of impulse and reaction water turbine.  10.4 Compare between impulse and reaction turbine.  10.5 Describe the construction of Pelton, Kaplan, and Francis water turbine.  10.6 Describe the operation of Pelton, Kaplan, and Francis water turbine.  10.7 State the specific speed of turbine.  10.8 Describe the governing system of impulse and reaction turbine.  10.9 Define draft tube.  10.10 Classify draft tube.</p>	03	06
11.	<p><b>RECIPROCATING PUMPS</b></p> <p>11.1 Define reciprocating pump.</p>	03	06

	<p>11.2 Classify reciprocating pump.</p> <p>11.3 List the parts of reciprocating pump.</p> <p>11.4 Describe the operation of different types of reciprocating pump.</p> <p>11.5 Define slip of reciprocating pump.</p> <p>11.6 Mention the function of an air vessel in a single-acting and double acting reciprocating pump.</p> <p>11.7 Describe the operation of the suction side and discharge side air vessel in a single-acting and double acting reciprocating pump.</p> <p>11.8 Deduce the formula to calculate the discharge of reciprocating pump.</p> <p>11.9 Solve the problem related to the reciprocating pump.</p>		
12.	<p><b>CENTRIFUGAL PUMPS</b></p> <p>12.1 Define centrifugal pump.</p> <p>12.2 Classify centrifugal pump.</p> <p>12.3 Compare between centrifugal and reciprocating pump.</p> <p>12.4 List the parts of centrifugal pump.</p> <p>12.5 Describe the operation of different types of centrifugal pump.</p> <p>12.6 Define cavitation of centrifugal pump.</p> <p>12.7 Mention the required power to drive a centrifugal pump.</p> <p>12.8 Mention the efficiencies of centrifugal pump.</p> <p>12.9 State priming of a centrifugal pump.</p>	<b>03</b>	<b>06</b>
13.	<p><b>HYDRAULIC SYSTEMS</b></p> <p>13.1 Interpret oil power hydraulic system.</p> <p>13.2 State pascal law.</p> <p>13.3 Mention the application of pascal law.</p> <p>13.4 Describe the industrial applications of oil power hydraulic and pneumatic system.</p> <p>13.5 List the basic components of hydraulic system.</p> <p>13.6 Describe the function of components in a hydraulic circuit.</p> <p>13.7 Define filter, oil reservoir, coupling, motor and pump of hydraulic System.</p> <p>13.8 Describe the function of filter, oil reservoir, coupling, motor and pump of hydraulic system.</p> <p>13.9 Classify filters, seal, and sealing materials.</p> <p>13.10 Mention the function of oil reservoirs, coupling, motors, and pump.</p>	<b>04</b>	<b>05</b>
14.	<p><b>HYDRAULIC DEVICES</b></p> <p>14.1 State hydraulic devices.</p> <p>14.2 List the hydraulic devices.</p> <p>14.3 Mention the function of hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic crane and hydraulic lift.</p> <p>14.4 Describe the construction of various hydraulic devices.</p> <p>14.5 Describe the operation of different types of hydraulic devices.</p>	<b>02</b>	<b>06</b>
15.	<p><b>COMPONENTS OF PNEUMATIC SYSTEMS</b></p> <p>15.1 Define pneumatic system.</p> <p>15.2 Illustrate oil power pneumatic system.</p> <p>15.3 State air compressors.</p> <p>15.4 List basic components of air compressor.</p> <p>15.5 Mention the function of air compressor.</p> <p>15.6 State different types of air cylinder.</p> <p>15.7 Mention the function of different types air cylinders.</p> <p>15.8 State the air filter, regulator, and lubricator.</p> <p>15.9 List the necessity of air filters, regulators, and lubricators in a pneumatic circuit.</p> <p>15.10 Describe the Installation, maintenance process, and application of air cylinders.</p>	<b>04</b>	<b>10</b>
	<b>Total</b>	<b>48</b>	<b>90</b>

## DETAILED SYLLABUS (PRACTICAL)

Sl.	Experiment Name with procedure	Class (3 Period)	Marks (Continuous)
1.	<p><b>CALIBRATE A BOURDON TUBE PRESSURE GAUGE WITH A DEAD WEIGHT GAUGE.</b></p> <p>1.1 Collect bourdon tube pressure gage &amp; dead weight gage.            1.2 Set proper tools &amp; instruments in the working place.            1.3 Follow the working procedure for calibration of bourdon tube pressure gage dead weight gage.            1.4. Measure data.            1.5 Maintain the record of performed tasks.</p>	<b>1</b>	<b>2</b>
2.	<p><b>VERIFY BERNOULLI'S EQUATION BY BERNOULLI'S APPARATUS EQUIPPED WITH A HYDRAULIC TEST BENCH.</b></p> <p>2.1 Collect Bernoulli's apparatus equipped with a hydraulic test bench.            2.2 Set proper tools &amp; instruments in the working place.            2.3 Follow the working procedure for verifying Bernoulli's apparatus equipped with a hydraulic test bench.            2.4 Measure data.            2.5 Maintain the record of performed tasks.</p>	<b>2</b>	<b>2</b>
3.	<p><b>DETERMINE THE DISCHARGE OF WATER THROUGH A PIPE BY THE VENTURI METER OR ORIFICE METER EQUIPPED WITH A HYDRAULIC TEST BENCH.</b></p> <p>3.1 Collect venturi meter with Hydraulic test bench.            3.2 Collect orifice apparatus equipped with Hydraulic test bench.            3.3 Set proper tools &amp; instruments in the working place.            3.4 Follow the working procedure for verifying Bernoulli's apparatus equipped with a hydraulic test bench.            3.5 Determine the discharge of water using measuring data.            3.6 Maintain the record of performed tasks.</p>	<b>1</b>	<b>2</b>
4.	<p><b>DETERMINE THE LOSS OF HEAD DUE TO FRICTION BY FLUID FRICTION APPARATUS.</b></p> <p>4.1 Collect friction apparatus.            4.2 Set proper tools &amp; instruments in the working place.            4.3 Follow the working procedure to determine the loss of head due to sudden enlargement of pipe by the manometer.            4.4 Determine the loss of different head loss due to sudden enlargement of the pipe by using measuring data.            4.5 Maintain the record of performed tasks.</p>	<b>2</b>	<b>2</b>
5.	<p><b>TEST THE PERFORMANCE OF A RECIPROCATING PUMP WITH THE RECIPROCATING PUMP TEST RIG.</b></p> <p>5.1 Collect a reciprocating pump with the reciprocating pump test rig. 5.2 Set proper tools &amp; instruments in the working place.            5.3 Follow the working procedure to determine the performance of a reciprocating pump with the reciprocating pump test rig.            5.4 Determine the performance of a reciprocating pump with the reciprocating pump test rig.            5.5 Maintain the record of performed tasks.</p>	<b>2</b>	<b>2</b>
6.	<p><b>TEST THE PERFORMANCE OF A CENTRIFUGAL PUMP WITH THE CENTRIFUGAL PUMP TEST RIG.</b></p> <p>6.1 Collect the centrifugal pump with the centrifugal pump test rig.            6.2 Set proper tools &amp; instruments in the working place.            6.3 Follow the working procedure to determine the performance of a</p>	<b>2</b>	<b>3</b>

	centrifugal pump with the centrifugal pump test rig. 6.4 Determine the performance of a centrifugal pump with the centrifugal pump test rig. using measuring data. 6.5 Maintain the record of performed tasks.		
7.	<b>TEST THE PERFORMANCE OF AN IMPULSE TURBINE WITH THE IMPULSE (PELTON WHEEL) TURBINE TEST RIG.</b> 7.1 Collect the impulse turbine with the impulse (Pelton wheel) turbine test rig. 7.2 Set proper tools & instruments in the workplace. 7.3 Follow the working procedure to determine the performance of the impulse turbine with the impulse (Pelton wheel) turbine test rig. 7.4 Determine the performance of the impulse turbine with the impulse (Pelton wheel) turbine test rig using measuring data. 7.5 Maintain the record of performed tasks.	<b>1</b>	<b>3</b>
8.	<b>DETERMINE THE LEVERAGE AND MECHANICAL ADVANTAGE OF A HYDRAULIC PRESS.</b> 8.1 Collect the apparatus. 8.2 Set proper tools & instruments in the workplace. 8.3 Follow the working procedure to determine the leverage and mechanical advantage of a hydraulic press. 8.4 Determine the leverage and mechanical advantage of a hydraulic press by using measuring data. 8.5 Maintain the record of performed tasks.	<b>1</b>	<b>3</b>
9.	<b>OPERATE TWO-STAGE RECIPROCATING AIR COMPRESSOR</b> 9.1 Collect the components of a two-stage reciprocating air compressor. 9.2 Identify components of a two-stage reciprocating air compressor. 9.3 Set proper tools & instruments in the workplace. 9.4 Follow the working procedure for the operation of a two-stage reciprocating air compressor. 9.5 Maintain the record of performed tasks.	<b>2</b>	<b>3</b>
10.	<b>PERFORM AUTOMATIC OPERATION OF THE DOUBLE-ACTING CYLINDER IN A SINGLE CYCLE USING THE LIMIT SWITCH.</b> 10.1 Collect the double-acting cylinder and air compressor. Collect Limit switch. 10.2 Set tools & instruments in the workplace. 10.3 Maintain the record of performed task.	<b>2</b>	<b>3</b>
Total		<b>16</b>	<b>25</b>

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

SI	Item Name	Quantity
01	Bourdon tube pressure gauge with a dead weight gauge.	1 no
02	Hydraulic test bench.	2 no
03	Venturi meter and orifice meter equipped with a hydraulic test bench.	2 nos
04	Reciprocating pump test rig	01 no.
05	Centrifugal pump test rig	01 no.
06	Impulse turbine (Pelton wheel) test rig	01 no.
07	Hydraulic press.	02 no.
08	Two-stage reciprocating air compressor	01 no.
09	Double-acting cylinder and limit switch.	05 nos.

**RECOMMENDED BOOKS:**

Sl.	Book Name	Writer Name	Publisher Name & Edition
01	A textbook of Fluid Mechanics and Hydraulic Machines	Dr. R.K. Bansal	LAXMI Publications (P) Ltd. Ninth Edition
02	Fluid Mechanics	Dr. AK Jain	Khanna Publishers, 12 <sup>th</sup> Edition.
03	Fluid Mechanics and Machinery	C.P KOTHANDARAMAN R. RUDRAMOORTHY	
04	Hydraulics and Fluid Mechanics Machine	RS Khurmi	S. Chand & Co. Ltd. Twentieth Edition
05	Hydraulic and Pneumatic Power and Control Design, Performance and Application	Yeaple	McGraw Hill, New York.
06	Pneumatic Controls	Festo Didactic	Festo Didactic
07	Pneumatics Control: An Introduction to the Principles	Werner Deppert and Kurt Stoll	Vogel – Verlag

**WEBSITE REFERENCES:**

Sl	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

**Board may rearrange marks distribution for question setting (If necessary)**

SUBJECT CODE	SUBJECT NAME	PERIOD PER WEEK		CREDIT
27053	Advanced Welding -1	T	P	C
		2	6	4

<b>Rationale</b>	<p>The term welding is used to cover a wide range of bonding techniques. Now a day's many processes of welding have been developed and probably there is no industry which is not using welding processes in fabrication of products in some form or the others. This is most rapid and easiest way to fabrication and assembly of metal parts. One beauty of welding is comparison to other processes of joining metals is that by this process we can have more than 100% strength of joint and it is very easy process. Welding is now a day extensively used in the following fields: automobile industry, structural works, boiler making, tank making, machine repair, ship frames, pipe line fabrication etc. Gas cutting is another field of application of welding process which is playing very important role in industry.</p> <p>We will be dealing with common processes of welding in use these days. Such as arc welding, gas welding, thermit welding, soldering, brazing etc. The equipment's used for each processes and the way of preparation of joint and various operation is necessary.</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. State the principle of Arc, Gas, Resistance and Thermit welding.</li> <li>2. Describe the processes of Arc, Gas, Resistance and Thermit welding.</li> <li>3. Describe the processes of Soldering and Brazing.</li> <li>4. State the equipment's of welding.</li> <li>5. Explain the different position of welding.</li> <li>6. State diagnoses polarity of Arc welding.</li> <li>7. Compare different types of welding.</li> <li>8. Interpret defects of welding.</li> <li>9. Prepare test report on welding.</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. Practice OHS.</li> <li>2. Select electrode for Arc welding.</li> <li>3. Set current and voltage for Arc welding.</li> <li>4. Select polarity for Arc welding.</li> <li>5. Demonstrate different types of joints.</li> <li>6. Operate welding machine.</li> <li>7. Perform Arc welding.</li> <li>8. Perform Gas welding.</li> <li>9. Perform Spot welding.</li> <li>10. Perform Thermit welding.</li> <li>11. Perform Brazing and Soldering.</li> <li>12. Identify defects, causes and remedies of welding.</li> <li>13. Perform welding test.</li> </ol>



## DETAILED SYLLABUS (THEORY)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1	<b>Introduction to welding</b> 1.1 Define welding. 1.2 Classify welding processes. 1.3 Discuss the advantages and disadvantages of welding processes. 1.4 Describe weld ability of metals. 1.5 Explain the metallurgical change in welding. 1.6 Describe different types of welding joint. 1.7 Explain welding methods. 1.8 Describe the different positions of welding. 1.9 Describe occupational health and safety (OHS) for welding shop.	02	06
2	<b>Arc welding process</b> 2.1 Define Arc welding. 2.2 Explain different types of Arc welding. 2.3 Describe the principles of Arc welding process. 2.4 Explain the effects of striking voltage, arc voltage and open circuit voltage. 2.5 Explain the voltage and current regulation of the Arc welding set. 2.6 Describe electrode with specification. 2.7 Describe the ingredients used in coating on electrode. 2.8 Describe the selection procedure of electrode. 2.9 Explain different types of Polarity. 2.10 Describe electric Arc welding process.	04	07
3	<b>Gas welding</b> 3.1 State Gas welding. 3.2 State different types of Gas welding flame. 3.3 State the procedure to apply natural gas in Gas welding process. 3.4 Compares among oxygen-acetylene and liquefied-petroleum gas (LPG) cylinder. 3.5 Explain the uses of flux in gas welding. 3.6 Mention the uses of filler rod of gas welding. 3.7 Describe the oxy-acetylene and oxy-LPG welding process. 3.8 Describe back fire and flash back. 3.9 Describe pre-heat and gas economizer. 3.10 Mention safety precautions of gas welding.	04	07
4	<b>Equipment's of gas welding</b> 4.1 State the principles of gas regulators. 4.2 Describe different types of regulators. 4.3 Describe oxygen, acetylene and natural gas cylinder. 4.4 Explain the operating principles of welding torches.	03	06

	<p>4.5 Describe the uses of different types of welding torches.</p> <p>4.6 Interpret different types of torch tips.</p> <p>4.7 Describe selection procedure of torch tips.</p> <p>4.8 Mention the uses of oxy-acetylene and oxy-LPG welding.</p> <p>4.9 Mention safety rules for equipment of gas welding.</p>		
<b>5</b>	<p><b>Soldering and Brazing</b></p> <p>5.1 Define Soldering and Brazing.</p> <p>5.2 Compare between Soldering and Brazing.</p> <p>5.3 Describe composition of Solders.</p> <p>5.4 Mention filler metals used in Soldering and Brazing.</p> <p>5.5 Describe essential steps in Soldering operation.</p> <p>5.6 Describe essential steps in Brazing operation.</p> <p>5.7 Explain different types of flux used in Soldering and Brazing.</p>	<b>02</b>	<b>04</b>
<b>6</b>	<p><b>Gas cutting</b></p> <p>6.1 Describe the construction of gas cutting torch.</p> <p>6.2 Describe the selection criteria of gas cutting torch tip.</p> <p>6.3 Distinguish between a gas welding torch and a gas cutting torch.</p> <p>6.4 Describe flame machining and gouging.</p> <p>6.5 Compare the advantages and disadvantages of gas cutting and arc cutting.</p> <p>6.6 Describe gas cutting processes.</p> <p>6.7 Mention the safety precautions in gas cutting.</p>	<b>04</b>	<b>06</b>
<b>7</b>	<p><b>Resistance welding</b></p> <p>7.1 Describe the principles of Resistance welding.</p> <p>7.2 Describe the construction and operation of resistance welding machine.</p> <p>7.3 Classify resistance welding.</p> <p>7.3 Describe the different types of resistance welding processes.</p> <p>7.4 List the advantages and limitations of resistance welding process.</p> <p>7.5 Distinguish between resistances welding with other welding processes.</p> <p>7.6 Mention safety precautions of resistance welding.</p>	<b>03</b>	<b>05</b>
<b>8</b>	<p><b>Groove (G) &amp; Fillet (F) welding</b></p> <p>8.1 Describe the G position of arc welding technique</p> <p>8.2 Describe the F-position of arc welding technique.</p> <p>8.3 Describe 1F &amp; 2F position for plate welding.</p> <p>8.4 Explain 3F &amp; 4F position for plate welding.</p> <p>8.5 Describe 1G &amp; 2G position for plate and pipe welding.</p> <p>8.6 Describe 3G &amp; 4G position for plate welding.</p> <p>8.7 Explain 5G &amp; 6G position for pipe welding.</p> <p>8.8 Describe 6GR (Resected) position for pipe welding.</p> <p>8.9 Mention care and safety needed for various G&amp;F-position plate and pipe welding.</p>	<b>03</b>	<b>07</b>
<b>9</b>	<p><b>Thermit welding</b></p>	<b>02</b>	<b>04</b>

	<p>9.1 State the principle of thermit welding.</p> <p>9.2 Mention applications of thermit welding.</p> <p>9.3 Point out the advantages and limitations of thermit welding.</p> <p>9.4 Describe thermit welding processes.</p>		
<b>10</b>	<p><b>Welding Defects</b></p> <p>10.1 Describe welding defects.</p> <p>10.2 Mention different types of welding defect.</p> <p>10.3 List the defects of welding.</p> <p>10.4 State the causes of defects in welding.</p> <p>10.5 Describe the remedies of defects in welding.</p> <p>10.6 Describe the inspection methods of detecting welding defects.</p>	<b>03</b>	<b>06</b>
<b>11</b>	<p><b>Testing of welding joints</b></p> <p>11.1 Explain the necessity of testing the welds.</p> <p>11.2 Describe the non-destructive tests of detecting welding defects.</p> <p>11.3 Describe the destructive tests of welding.</p> <p>11.4 State the significance of testing welding joint.</p>	<b>02</b>	<b>02</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>Marks (Continuous)</b>
<b>1</b>	<p><b>PERFORM SETTING OF ARC WELDING MACHINE.</b></p> <p>1.1 Follow occupational health and safety (OHS).</p> <p>1.2 Collect tools, equipment and accessories.</p> <p>1.3 Set current and voltage according to the job requirements.</p> <p>1.4 Select and set electrode with electrode holder.</p> <p>1.5 Maintain the record of performed task.</p>	<b>1</b>	<b>2</b>
<b>2</b>	<p><b>PERFORM THE STRAIGHT WELD BEAD WELDING ON MS FLAT BAR IN FLAT POSITION BY ELECTRIC ARC WELDING.</b></p> <p>2.1 Follow occupational health and safety (OHS).</p> <p>2.2 Collect tools, equipment and accessories.</p> <p>2.3 Prepare drawing.</p> <p>2.4 Select materials.</p> <p>2.5 Select and hold electrode.</p> <p>2.6 Set the voltage and current according to metal.</p> <p>2.7 Cut MS flat bar according specification.</p> <p>2.8 Select and practice PPE.</p> <p>2.9 Perform straight weld bead by electric arc welding m/c.</p> <p>2.10 Off the connection of arc welding machine.</p> <p>2.11 Clean the job and work place.</p> <p>2.12 Maintain the record of performed task.</p>	<b>2</b>	<b>3</b>

<b>3</b>	<p><b>PERFORM LAP JOINT ON MS FLAT BAR IN FLAT POSITION (1F) BY ELECTRIC ARC WELDING.</b></p> <p>3.1 Follow occupational health and safety (OHS).  3.2 Collect tools, equipment and accessories.  3.3 Prepare drawing.  3.4 Select materials.  3.5 Select and hold electrode.  3.6 Set the voltage and current according to metal.  3.7 Cut MS flat bar according drawing.  3.8 Select and practice PPE.  3.9 Perform lap joint on MS flat bar in flat position by electric arc welding m/c.  3.10 Off the connection of arc welding machine.  3.11 Clean the job and work place.  3.12 Maintain the record of performed task.</p>	<b>2</b>	<b>3</b>
<b>4</b>	<p><b>PERFORM SINGLE BUTT JOINT ON MS FLAT BAR IN FLAT POSITION BY ELECTRIC ARC WELDING.</b></p> <p>4.1 Follow occupational health and safety (OHS).  4.2 Collect tools, equipment and accessories.  4.3 Prepare drawing.  4.4 Select materials.  4.5 Select and hold electrode.  4.6 Set the voltage and current according to metal.  4.7 Cut MS flat bar according drawing.  4.8 Select and practice PPE.  4.9 Perform single butt joint on MS flat bar in flat position by electric arc welding m/c.  4.10 Off the connection of arc welding machine.  4.11 Clean the job and work place.  4.12 Maintain the record of performed task.</p>	<b>2</b>	<b>3</b>
<b>5</b>	<p><b>PERFORM T JOINT ON MS FLAT BAR IN HORIZONTAL POSITION (2F) BY ELECTRIC ARC WELDING.</b></p> <p>5.1 Follow occupational health and safety (OHS).  5.2 Collect tools, equipment and accessories.  5.3 Prepare drawing.  5.4 Select materials.  5.5 Select and hold electrode.  5.6 Set the voltage and current according to metal.  5.7 Cut MS flat bar according drawing.  5.8 Select and practice PPE.  5.9 Perform T joint on MS flat bar in horizontal position by electric arc welding m/c.  5.10 Off the connection of arc welding machine.  5.11 Clean the job and work place.  5.12 Maintain the record of performed task.</p>	<b>2</b>	<b>3</b>

<b>6</b>	<p><b>PERFORM STRAIGHT BEAD ON MS SHEET BY GAS WELDING.</b></p> <p>6.1 Follow occupational health and safety (OHS).  6.2 Collect tools, equipment and accessories.  6.3 Prepare drawing.  6.4 Select and cut metal according to drawing and clean metal.  6.5 Select gas welding tools, filler metal, flux and accessories.  6.6 Select and adjust oxygen and acetylene pressure regulator of cylinder.  6.7 Select and practice PPE.  6.8 Make gas flame by adjusting oxygen and acetylene knob of welding torch.  6.9 Perform straight bead according to drawing.  6.10 Stop the gas flow.  6.11 Clean the job and work place.  6.12 Maintain the record of performed task.</p>	<b>2</b>	<b>3</b>
<b>7</b>	<p><b>PERFORM LAP JOINT ON MS SHEET IN FLAT POSITION BY GAS WELDING.</b></p> <p>7.1 Follow occupational health and safety (OHS).  7.2 Collect tools, equipment and accessories.  7.3 Prepare drawing.  7.4 Select and cut metal according to drawing and clean metal.  7.5 Select gas welding tools, filler metal, flux and accessories.  7.6 Select and adjust oxygen and acetylene pressure regulator of cylinder.  7.7 Select and practice PPE.  7.8 Make gas flame by adjusting oxygen and acetylene knob of welding torch.  7.9 Perform lap joint on MS sheet in flat position according to drawing.  7.10 Stop the gas flow.  7.11 Clean the job and work place.  7.12 Maintain the record of performed task.</p>	<b>1</b>	<b>3</b>
<b>8</b>	<p><b>PERFORM BUTT JOINT ON MS SHEET IN HORIZONTAL POSITION BY GAS WELDING.</b></p> <p>8.1 Follow occupational health and safety (OHS).  8.2 Collect tools, equipment and accessories.  8.3 Prepare drawing.  8.4 Select and cut metal according to drawing and clean metal.  8.5 Select gas welding tools, filler metal, flux and accessories.  8.6 Select and adjust oxygen and acetylene pressure regulator of cylinder.</p>	<b>1</b>	<b>3</b>

	<p>8.7 Select and practice PPE.</p> <p>8.8 Make gas flame by adjusting oxygen and acetylene knob of welding torch.</p> <p>8.9 Perform but joint on MS sheet in horizontal position according to drawing.</p> <p>8.10 Stop the gas flow.</p> <p>8.11 Clean the job and work place.</p> <p>8.12 Maintain the record of performed task.</p>		
<b>9</b>	<p><b>PERFORM STRAIGHT GAS CUTTING ON MS PLATE.</b></p> <p>9.1 Follow occupational health and safety (OHS).</p> <p>9.2 Collect tools, equipment and accessories.</p> <p>9.3 Prepare drawing.</p> <p>9.4 Select metal to be cut.</p> <p>9.5 Select gas cutting torch.</p> <p>9.6 Select and adjust oxygen and acetylene pressure regulator of cylinder.</p> <p>9.7 Select and practice PPE.</p> <p>9.8 Make gas flame by adjusting oxygen and acetylene knob of cutting torch.</p> <p>9.9 Perform straight gas cutting on MS plate.</p> <p>9.10 Stop the gas flow.</p> <p>9.11 Clean the job and work place.</p> <p>9.12 Maintain the record of performed task.</p>	<b>2</b>	<b>3</b>
<b>10</b>	<p><b>PERFORM BRAZING ON STEEL PIPES.</b></p> <p>10.1 Follow occupational health and safety (OHS).</p> <p>10.2 Collect tools, equipment and accessories.</p> <p>10.3 Prepare drawing.</p> <p>10.4 Select and cut metal according to drawing and clean metal.</p> <p>10.5 Select gas welding tools, filler metal, flux and accessories.</p> <p>10.6 Select and adjust oxygen and acetylene pressure regulator of cylinder.</p> <p>10.7 Select and practice PPE.</p> <p>10.8 Make gas flame by adjusting oxygen and acetylene knob of welding torch.</p> <p>10.9 Perform brazing on steel pipe according to drawing.</p> <p>10.10 Stop the gas flow.</p> <p>10.11 Clean the job and work place.</p> <p>10.12 Maintain the record of performed task.</p>	<b>1</b>	<b>3</b>
<b>11</b>	<p><b>MAKE A SQUARE WIRE MESH BY SPOT WELDING.</b></p> <p>11.1 Follow operational health and safety (OHS).</p> <p>11.2 Collect tools, equipment and accessories.</p> <p>11.3 Prepare drawing.</p> <p>11.4 Select materials.</p> <p>11.5 Select and hold electrode.</p> <p>11.6 Set the voltage and current according to metal.</p> <p>11.7 Cut wire according drawing.</p>	<b>1</b>	<b>3</b>

	<p>11.8 Select and practice PPE.</p> <p>11.9 Perform a square wire mesh by spot welding m/c.</p> <p>11.10 Clean the job and workplace.</p> <p>11.11 Maintain the record of performed task.</p>			
<b>12</b>	<p><b>PERFORM FILLET JOINTS ON MS FLAT BAR IN VERTICAL (3F) POSITION.</b></p> <p>12.1 Follow occupational health and safety (OHS).</p> <p>12.2 Collect tools, equipment and accessories.</p> <p>12.3 Prepare drawing.</p> <p>12.4 Select materials.</p> <p>12.5 Select and hold electrode.</p> <p>12.6 Set the voltage and current according to metal.</p> <p>12.7 Cut MS flat bar according drawing.</p> <p>12.8 Select and practice PPE.</p> <p>12.9 Perform fillet joint on MS flat bar in vertical (3F) position by electric arc welding m/c.</p> <p>12.10 Clean the job and workplace.</p> <p>12.11 Maintain the record of performed task.</p>	<b>2</b>	<b>2</b>	<b>3</b>
<b>13</b>	<p><b>PERFORM FILLET JOINTS ON MS FLAT BAR IN OVERHEAD (4F) POSITION.</b></p> <p>13.1 Follow occupational health and safety (OHS).</p> <p>13.2 Collect tools, equipment and accessories.</p> <p>13.3 Prepare drawing.</p> <p>13.4 Select materials.</p> <p>13.5 Select and hold electrode.</p> <p>13.6 Set the voltage and current according to metal.</p> <p>13.7 Cut MS flat bar according drawing.</p> <p>13.8 Select and practice PPE.</p> <p>13.9 Perform fillet joint on MS flat bar in overhead (4F) position by electric arc welding m/c.</p> <p>13.10 Clean the job and workplace.</p> <p>13.11 Maintain the record of performed task.</p>	<b>2</b>	<b>2</b>	
<b>14</b>	<p><b>PERFORM V-BUTT JOINTS ON MS FLAT BAR BY FLAT POSITION (1G) POSITION.</b></p> <p>14.1 Follow occupational health and safety (OHS).</p> <p>14.2 Collect tools, equipment and accessories.</p> <p>14.3 Prepare drawing.</p> <p>14.4 Select materials.</p> <p>14.5 Select and hold electrode.</p> <p>14.6 Set the voltage and current according to metal.</p> <p>14.7 Cut MS flat bar according drawing.</p> <p>14.8 Select and practice PPE.</p> <p>14.9 Perform V-butt joint on MS flat bar in flat position (1G) position by electric arc welding m/c.</p> <p>14.10 Clean the job and workplace.</p> <p>14.11 Maintain the record of performed task.</p>	<b>2</b>	<b>2</b>	

15	<p><b>PERFORM V-BUTT JOINTS ON MS PLATE BY HORIZONTAL (2G) POSITION.</b></p> <p>15.1 Follow occupational health and safety (OHS).  15.2 Collect tools, equipment and accessories.  15.3 Prepare drawing.  15.4 Select materials.  15.5 Select and hold electrode.  15.6 Set the voltage and current according to metal.  15.7 Cut MS flat bar according drawing.  15.8 Select and practice PPE.  15.9 Perform V-butt joint on MS plate by horizontal (2G) position by electric arc welding m/c.  15.10 Clean the job and work place.  15.11 Maintain the record of performed task.</p>	2	2	
16	<p><b>PERFORM V-BUTT JOINTS ON MS FLAT BAR BY VERTICAL (3G) POSITION.</b></p> <p>16.1 Follow occupational health and safety (OHS).  16.2 Collect tools, equipment and accessories.  16.3 Prepare drawing.  16.4 Select materials.  16.5 Select and hold electrode.  16.6 Set the voltage and current according to metal.  16.7 Cut MS flat bar according drawing.  16.8 Select and practice PPE.  16.9 Perform V-butt joint on MS flat bar by vertical (3G) position by electric arc welding m/c.  16.10 Clean the job and work place.  16.11 Maintain the record of performed task.</p>	2	2	
17	<p><b>PERFORM V-BUTT JOINTS ON MS FLAT BAR BY OVERHEAD (4G) POSITION.</b></p> <p>17.1 Follow occupational health and safety (OHS).  17.2 Collect tools, equipment and accessories.  17.3 Prepare drawing.  17.4 Select materials.  17.5 Select and hold electrode.  17.6 Set the voltage and current according to metal.  17.7 Cut MS flat bar according drawing.  17.8 Select and practice PPE.  17.9 Perform V-butt joint on MS flat bar by overhead (4G) position by electric arc welding m/c.  17.10 Clean the job and work place.  17.11 Maintain the record of performed task.</p>	2	2	3
18	<p><b>PERFORM V-BUTT JOINTS ON PIPE BY 5G POSITION.</b></p> <p>18.1 Follow occupational health and safety (OHS).  18.2 Collect tools, equipment and accessories.  18.3 Prepare drawing.  18.4 Select materials.  18.5 Select and hold electrode.</p>	1	2	



	18.6 Set the voltage and current according to metal. 18.7 Cut MS pipe according drawing. 18.8 Select and practice PPE. 18.9 Perform 5G welding on pipe by electric arc welding m/c. 18.10 Clean the job and work place. 18.11 Maintain the record of performed task.			
<b>19</b>	<b>PERFORM V-BUTT JOINTS ON PIPE BY 6G POSITION.</b> 19.1 Follow occupational health and safety (OHS). 19.2 Collect tools, equipment and accessories. 19.3 Prepare drawing. 19.4 Select materials. 19.5 Select and hold electrode. 19.6 Set the voltage and current according to metal. 19.7 Cut MS pipe according drawing. 19.8 Select and practice PPE. 19.9 Perform 6G welding on pipe by electric arc welding m/c. 19.10 Clean the job and work place. 19.11 Maintain the record of performed task.	<b>1</b>	<b>2</b>	
<b>20</b>	<b>PERFORM JOINING OF BROKEN SHAFT BY THERMITE WELDING.</b> 20.1 Follow occupational health and safety (OHS). 20.2 Collect tools, equipment and accessories. 20.3 Set the weld gap. 20.4 Apply clamp and fix the mould 20.5 Leave the thermit mixture into the crucible. 20.6 Preheat the end of the rail. 20.7 Ignite and let steel flow. 20.8 Remove the mould and excess head metal. 20.9 Grinding the joint. 20.10 Clean the job and work place. 20.11 Maintain the record of performed task.	<b>1</b>	<b>2</b>	
<b>Total</b>		<b>32</b>	<b>50</b>	

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

<b>SI</b>	<b>Item Name</b>	<b>Quantity</b>
01	Arc welding machine	5 nos
02	Oxygen cylinder	5 nos
03	Acetylene cylinder	5 nos
04	Spot welding machine	2 nos
05	Gas pressure regulator	10 nos
06	Electrode holder	5 nos
07	Welding cable	5 nos
08	Earth clamp	5 nos

09	Gas welding torch	10 nos
10	Gas cutting torch	10 nos
11	Thermit welding equipment's	8 nos
12	Spark lighter	10 nos
13	Welding helmet	20 nos
14	Hand shield	20 nos
15	Hand Gloves	30 pair
16	Apron	25 nos
17	Safety shoes	25 pair

**RECOMMENDED BOOKS:**

SI	Book Name	Writer Name	Publisher Name & Edition
01	Welding processes Hand book	Klas Weman	Woodhead Publication Ltd.(2006)
02	Advanced Welding processes	John Norrish.	Woodhead Publication Ltd. (2006)
03	Advanced Joining Technology	T.H.North.	Springer international publishing (October,5,2011)
04	Production Technology	R.K Jain	Khanna Publishers
05	Advanced Manufacturing Technologies	Kapil Gupta.	Springer international publishing (April,29,2017)
06	Advanced Welding Technology	Ashutosh, Som	Excel Books (1, Dec, 2010)

**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

**Board may rearrange marks distribution for question setting (If necessary)**

SUBJECT CODE	SUBJECT NAME	PERIOD PER WEEK		CREDIT
		T	P	
27151	Automotive Electricity, Electronic & Automation	2	3	3

<b>Rationale</b>	Automotive Electricity, Electronics & Automation deals with the Function, Construction and Operation of Electrical, Electronics devices used in Automobile. Find out the Troubleshooting, diagnosis, Color Coding, wiring and electronic dashboard Instruments as well as applied in Intelligent Transport System (ITS), Cruise Control, Collision Avoidance System (CAS), Steering and Speed Control, Vehicle Tracking and Traffic Signaling System.
<b>Learning Outcome (Theoretical)</b>	<p><b>Students will be able to</b></p> <ol style="list-style-type: none"> <li>1. State Construction and Operation of Electrical, Electronics devices used in Automobile.</li> <li>2. Interpret the process of Troubleshooting, diagnosis, Color Coding and wiring</li> <li>3. Describe Electronic Dashboard Instruments</li> <li>4. State Intelligent Transport System (ITS)</li> <li>5. Explain Cruise Control</li> <li>6. Interpret Collision Avoidance System (CAS)</li> <li>7. Describe the Operating procedure of Steering, Speed Control, and Vehicle Tracking</li> </ol>
<b>Learning Outcome (Practical)</b>	<p><b>Students will be able to</b></p> <ol style="list-style-type: none"> <li>1. Identify Electrical, Electronics devices used in Automobile</li> <li>2. Perform Troubleshooting, diagnosis, Color Coding, Wiring</li> <li>3. Operate Electrical, Electronics devices used in Automobile</li> <li>4. Identify Electronic Dashboard Instruments.</li> <li>5. Determine Intelligent Transport System (ITS)</li> <li>6. Operate the Cruise Control</li> <li>7. Identify Collision Avoidance System (CAS)</li> <li>8. Operate Steering and Speed Control</li> <li>9. Perform Vehicles Tracking</li> </ol>

## DETAILED SYLLABUS (THEORY)

Unit	Topics with Contents	Class (1 Period)	Final Marks
<b>1.</b>	<b>Storage Battery</b> 1.1 Define storage battery. 1.2 Outline alkaline batteries constructed of Nickel-Iron battery, Nickel-cadmium battery and Silver-zinc battery. 1.3 Explain the construction and operation of lead acid battery. 1.4 State the battery voltage, battery rating, battery specification and chemical reaction happens in battery cell during charging and discharging period. 1.5 Mention factors affecting battery life. 1.6 List the causes of battery faulty and failure. 1.7 Describe the process of storing of dry, wet and uncharged battery. 1.8 Describe the different types of battery charging system. 1.9 Analyze the battery terminal test, leakage test, Specific gravity test, Open circuit voltage test, High discharge test & Capacity test. 1.10 State the low maintenance, maintenance free and hybrid battery.	<b>04</b>	<b>06</b>
<b>2</b>	<b>Ignition system</b> 2.1 Outline the purposes of ignition system. 2.2 State different types of ignition system. 2.3 Describe the operation of magneto, CDI (Capacitor Discharge Ignition), DLI (Distributor less Ignition) & DIS (Direct Ignition System). 2.4 Outline the advantages & disadvantages of ignition system. 2.5 Describe the procedure of ignition timing setting. 2.6 State the purposes of spark plug. 2.7 Illustrate the construction of the spark plug. 2.8 Outline the classification of the spark plug. 2.9 Describe the procedure of spark plug servicing. 2.10 List the defects of the spark plug.	<b>04</b>	<b>06</b>
<b>3</b>	<b>Charging and starting system</b> 3.1 Describe the operation of the automotive charging system with circuit diagram. 3.2 Describe the construction & operation of the alternator. 3.3 Describe the operation of regulator. 3.4 Explain the self-excitation and battery excitation of alternator. 3.5 Describe the procedure of testing, servicing and repairing of alternator with components. 3.6 Define starting motor. 3.7 List the components of starting motor and its classification. 3.8 Describe the operation of electric motor starting system with circuit diagrams. 3.9 Explain the starter motor drive mechanism. 3.10 Explain the operation of the Hybrid vehicle charging system.	<b>03</b>	<b>06</b>
<b>4</b>	<b>Vehicle Wiring and harnesses equipment (light, horn and windshield wiper) system.</b> 4.1 Illustrate the wiring diagram of a modern vehicle. 4.2 List the typical cable size and color code used in vehicles. 4.3 Outline the purposes of lighting system of vehicle. 4.4 List the components of the head light. 4.5 Describe the method of head light adjustment. 4.6 Explain the different types of flasher used in automobile. 4.7 Outline the different types of horn used in automobile. 4.8 Describe the operation of the electric horn circuit with diagram. 4.9 State the purposes of windshield wiper, and windshield washer mechanism.	<b>02</b>	<b>06</b>
<b>5</b>	<b>Electronic fuel injection(EFI)</b> 5.1 Define electronic fuel injection (EFI) system. 5.2 Mention different types of EFI system. 5.3 List the components of the EFI system. 5.4 Describe the principle of operation of EFI system with diagram. 5.5 State advantages and disadvantage of EFI system over carburetor system. 5.6 Explain the D-Jetronic, L-Jetronic and K-Jetronic system. 5.7 Define the electronic fuel injection system of a diesel engine. 5.8 Explain the principle of operation of the CRDI system with diagram.	<b>03</b>	<b>06</b>

	5.9 Explain the advantages of the CRDI system over conventional systems		
<b>6</b>	<b>Electronic components</b> 6.1 Define sensor and actuator. 6.2 Outline the purposes of the sensor used in diesel & gasoline-EFI system. 6.3 Name different types of sensors used in automobile. 6.4 Describe the operation of lambda (oxygen) sensor, air flow sensor, engine temperature sensor throttle position sensor, manifold absolute pressure (MAP) sensor, knock sensor, intake air temperature sensor. 6.5 Mention different types of actuators used in automobile. 6.6 Describe the operation of different types of actuators such as an idle speed control (ISC) valve, gasoline & diesel fuel injection, igniter, circuit opening relay & EFI main relay. 6.7 Describe the working principle of the electronic control module. 6.8 Describe the procedure of electronic fuel injector test by diagnostic tool.	<b>03</b>	<b>06</b>
<b>7</b>	<b>Dash board instruments</b> 7.1 List the dash board instruments. 7.2 List the analog and electronic instruments on the dashboard with the figure. 7.3 Describe the operation of tachometer, temperature gauge, fuel gauge, pressure gauge, oil pressure gauge, speedometer, odometer and trip meter (both analog and digital). 7.4 Explain the operation of trip computer with block diagram.	<b>02</b>	<b>04</b>
<b>8</b>	<b>Vehicle Automation</b> 8.1 Define of vehicle automation. 8.2 State name of the operation mechanism viz Informing and warning functions, 8.3 Mention the function with levels of driving automation for on-road vehicles. 8.4 Mention the challenges of emerging sector for vehicle automation. 8.5 State the vehicle intelligent transport system. 8.6 Classify the primary category of intelligent transport system application. 8.7 Describe the primary category of intelligent transport system application. 8.8 List the component of vehicle intelligent transport system. 8.9 Explain the benefits of ITS.	<b>04</b>	<b>06</b>
<b>9</b>	<b>Cruise Control and Collision Avoidance System</b> 9.1 List of Component of Cruise Control. 9.2 Mention the Function of cruise control component. 9.3 Describe the operation of each component of cruise control system. 9.4 State advantages and disadvantages of cruise control system. 9.5 State operation principle of automobile collision avoidance system. 9.6 Point out the variety of sensor used in collision avoidance system. 9.7 Mention the function of collision avoidance system. 9.8 State the function of automobile collision avoidance system.	<b>02</b>	<b>04</b>
<b>10</b>	<b>Steering, Speed Control and tracking system</b> 10.1 Name of the sensor used in vehicle steering and speed control. 10.2 Draw the systematic diagram of steering control system. 10.3 Illustrate the hardware configuration of steering control system. 10.4 State the vehicle tracking system. 10.5 List the component of vehicle tracking system. 10.6 Discuss the GPS technology in vehicle tracking system. 10.7 Mention possible benefit of using GPS tracking system. 10.8 Outline the application of vehicle tracking system. 10.9 Explain the function of vehicle tracking system. 10.10 Describe the intelligent parking assist system.	<b>03</b>	<b>06</b>
<b>11</b>	<b>Automotive Night Vision (ANV) and Blind Spot Monitoring</b> 11.1 State the automotive night vision. 11.2 Mention the major function of automotive night vision. 11.3 State Adaptive night vision, Road sing detection and recognition, Spot light projection and Scene zooming. 11.4 Describe the function of automotive night vision. 11.5 List possible benefit of automotive night vision. 11.6 Define the automotive blind spot monitoring. 11.7 Mention different types of automotive blind spot monitoring	<b>02</b>	<b>04</b>

	11.8 State Active and Passive blind spot monitor. 11.9 Mention Function of automotive blind spot monitoring.		
	<b>Total</b>	<b>32</b>	<b>60</b>

### DETAILED SYLLABUS (PRACTICAL)

Sl.	Experiment Name with procedure	Class (3 Period)	Marks (Continuous)
<b>1</b>	<b>Perform the test of storage battery.</b> 1.1 Identify the components of a lead acid battery. 1.2 Observe the lead acid battery by cutting an old (rejected) lead acid battery. 1.3 Prepare the procedure of preparing electrolyte. 1.4 Open the vent plugs. 1.5 Topping up the battery. 1.6 Measure specific gravity of all cells by hydrometer and record the readings. 1.7 Perform battery maintenance and safety precautions. 1.8 Determine the reading and find out the problem of battery. 1.9 Prepare and submit the report.	<b>2</b>	<b>3</b>
<b>2</b>	<b>Perform charging of lead acid battery.</b> 2.1 Clean the post terminals and topping up the battery. 2.2 Connect the battery with charger. 2.3 Set voltage and current for slow, quick & trickle charging. 2.4 Set voltage and current for charging more than one battery at a time in series connection. 2.5 Set voltage and current for charging more than one battery at a time in parallel connection. 2.6 Check hydrometer test and high discharge load test. 2.7 Compare the hydrometer reading. 2.8 Prepare and submit the report.	<b>2</b>	<b>3</b>
<b>3</b>	<b>Perform the Ignition system test.</b> 3.1 Identify the components of Ignition coil system. 3.2 Connect the components and complete the wiring of Ignition system. 3.3 Conduct Short, open, ground test of an ignition coil. 3.4 Open the spark plug from the cylinder head. 3.5 Clean the spark plug perfectly. 3.6 Adjust the gap accurately. 3.7 Check the intensity of the spark. 3.8 Fix or replace the spark plug. 3.9 Prepare and submit the report.	<b>3</b>	<b>3</b>
<b>4</b>	<b>Perform charging circuit of automobile.</b> 5.1 Identify the components of charging circuit. 5.2 Remove the alternator and alternator regulator from the engine. 5.3 Clean the alternator and alternator regulator. 5.4 Reinstall the alternator and alternator regulator. 5.5 Complete the charging circuit. 5.6 Test the operation of charging circuit to measure performance. 5.7 Prepare and submit the report.	<b>1</b>	<b>2</b>
<b>5</b>	<b>Perform the starting motor test</b> 4.1 Identify the components of starting motor. 4.2 Remove the starting motor from the engine. 4.3 Open circuit, short circuit & ground test of starting motor. 4.4 Pull in coil, hold in coil, terminal point check and test of solenoid switch. 4.5 Perform No load and on load test of starting motor. 4.6 Assemble the starting motor. 4.7 Prepare and submit the report.	<b>1</b>	<b>2</b>
<b>6</b>	<b>Perform the automotive lighting ,horn and windshield wiper</b> 6.1 Identify the lighting circuit of automobile. 6.2 Connect and complete the wiring of lighting circuit on a board or vehicle. 6.3 Test the light, fuse, relay and circuit. 6.4 Conduct the lighting circuit operation. 6.5 Identify the components of horn circuit.	<b>2</b>	<b>3</b>

	6.6 Connect the horn circuit on a circuit board. 6.7 Test the operation of horn circuit, Adjust the perfect tone. 6.8 Test the operation of windshield wiper & washer circuit. 6.9 Fix or replace of windshield wiper & washer circuit if required 6.10 Prepare and submit the report.		
<b>7</b>	<b>Perform the test of electronic fuel injection (EFI) system.</b> 7.1 Identify different component of EFI system. 7.2 Test the work ability of injector & sensors. 7.3 Reinstall or replace the injector & sensors if required. 7.4 Define the electronic fuel injection system of a diesel engine. 7.5 Observe the principle of operation of the CRDI system with diagram. 7.6 Observe the advantages of the CRDI system over conventional systems 7.7 Prepare and submit the report.	<b>2</b>	<b>3</b>
<b>8</b>	<b>Observe the dashboard instruments of automobile.</b> 8.1 Identify the instruments of the dashboard. 8.2 Test the operating condition of instruments of dashboard. 8.3 Remove the dashboard faulty instruments. 8.4 Repair or replace the instruments. 8.5 Test the operating condition of dashboard. 8.6 Prepare and submit the report..	<b>1</b>	<b>2</b>
<b>9</b>	<b>Perform the cruise control</b> 9.1 Identify the component of cruise control. 9.2 Observe the Operation of cruise control system. 9.3 Identify the verity of sensor used in collision avoidance. 9.4 Perform the automobile collision avoidance system. 9.5 Prepare and submit the report.	<b>1</b>	<b>2</b>
<b>10</b>	<b>Perform the vehicle intelligent transport system</b> 10.1 Identify the vehicle intelligent transport system. 10.2 Identify the component of vehicle intelligent transport system. 10.3 Perform the primary category of intelligent transport system application. 10.4 Prepare and submit the report.	<b>1</b>	<b>2</b>
<b>Total</b>		<b>16</b>	<b>25</b>

### **REFERENCE BOOKS**

1. Automotive Electrical Equipment - W H Crouse.
2. Automobile Electrical and Electronic System - A Tranter.
3. Automotive Electronic System - Trevor Mellard.
4. Automobile Electrical Equipment - P L Kohli.
5. Vehicle Operation and performance- Giles. J.G., Illiffe Books Ltd., London, 1989.
6. Motor Vehicle Inspection- Crouse. W.H. and Anglin. D.L., McGraw Hill Book Co., 1978.
7. Internal Combustion engines- Ganesan. V., Tata McGraw Hill Co., 1994.
8. Kiino, Ron. "The Kiinote: Blinded by the Spot." Motor Trend. (April 17, 2012)
9. [http://www.motortrend.com/features/editorial/1202\\_the\\_kiinote\\_blinded\\_by\\_the\\_spot/](http://www.motortrend.com/features/editorial/1202_the_kiinote_blinded_by_the_spot/)

SUBJECT CODE	SUBJECT NAME	PERIOD PER WEEK		CREDIT
		T	P	
27152	POWER PLANT ENGINEERING	2	3	3

<b>Rationale</b>	<p>Diploma in Engineering students are required to acquire the knowledge and skill on the area of power generation with special emphasis on basic concept of power and energy, Renewable energy sources, Different types of power plants, Boiler and National authority of electrical power. Power Plant Engineering 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, and Biomass. The student will be better able to carry out their jobs effectively with this knowledge, which is a prerequisite for power generation fields, and the teaching and learning process has placed more focus on the practical rather than the theoretical.</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. Interpret sources of energy</li> <li>2. Explain Steam power plant</li> <li>3. Interpret gas turbine power plant</li> <li>4. Illustrate hydroelectric power plant</li> <li>5. Explain nuclear power plant</li> <li>6. Describe non-conventional source of energy</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. Identify 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. Measure voltage and current of fuel cells</li> </ol>



## DETAILED SYLLABUS (THEORY)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	<p><b>SOURCES OF ENERGY AND POWER PLANT</b></p> <p>1.1 List various sources of energy.            1.2 Define renewable energy.            1.3 Describe the various sources of Renewable Energy.            1.4 Compare between conventional and non-conventional energy.            1.5 Define power plant with classification.            1.6 Describe the basic operation of a power plant.            1.7 State the significance of power plant.            1.8 List the authorities of power supply in Bangladesh.            1.9 Explain grid system.            1.10 List the various types of power plant in Bangladesh with capacity.</p>	<b>02</b>	<b>04</b>
2	<p><b>BOILER</b></p> <p>2.1 Define Boiler.            2.2 Describe the different types of boiler based on tube content and operating pressure.            2.3 Compare between water tube and fire tube boiler.            2.4 Explain boiler Blow-down, boiler capacity, boiler efficiency and boiler scaling.            2.5 Illustrate the working principle of various boiler mountings and boiler accessories.            2.6 List the various specification parameters of a Boiler.            2.7 Discuss the feed water treatment process.            2.8 List maintenance equipment's of boiler.            2.9 List the visual inspection equipment.            2.10 Describe the startup and shut down procedure of boiler.</p>	<b>04</b>	<b>07</b>
3	<p><b>STEAM POWER PLANT</b></p> <p>3.1 Define Steam power plant.            3.2 Discuss various thermodynamic vapor power cycle with P-V and T-S diagram.            3.3 Describe the operation of a steam power plant with schematic diagram.            3.4 Mention the considering factors of site selection for steam power plant.            3.5 Describe the process of coal storage, coal handling, coal pulverizing, coal burning and ash handling.            3.6 Define draught and cooling tower.</p>	<b>03</b>	<b>07</b>

	<p>3.7 Explain the classification of chimney draught.</p> <p>3.7 Express the deduction of formulae to calculate chimney height.</p> <p>3.9 Describe the basic working principle of a cooling tower.</p> <p>3.10 Solve the problems related to chimney draught.</p>		
4	<p><b>GAS TURBINE AND COMBINED CYCLE POWER PLANT</b></p> <p>4.1 Define gas turbine power plant.</p> <p>4.2 Mention the various types of gas turbine power plant.</p> <p>4.3 Describe the operation of open and closed cycle type gas turbine plant with schematic diagram.</p> <p>4.4 Describe the gas turbine cycle efficiency.</p> <p>4.5 Describe the construction and operation of gas engine power plant.</p> <p>4.6 Mention the advantages and disadvantages of gas turbine power and gas engine power plant.</p> <p>4.7 Describe the starting and shut down procedure of gas turbine power plant.</p> <p>4.8 Define combined cycle power plant.</p> <p>4.9 Explain the working procedure of a combined cycle power plant with Heat Recovery Steam Generator.</p> <p>4.10 Mention the advantages of a combined cycle power plant.</p>	03	05
5	<p><b>DIESEL POWER PLANT</b></p> <p>5.1 Describe the operation of a diesel power plant.</p> <p>5.2 Draw the schematic diagram of a diesel power plant.</p> <p>5.3 Mention the advantages and disadvantages of a diesel power plant.</p> <p>5.4 Describe the starting and shut down procedure of a diesel power plant.</p> <p>5.5 Explain the fuel storage and handling method for large scale diesel power plant.</p> <p>5.6 Describe the operation of portable power generation unite.</p> <p>5.7 Point out the considering factors to select the site of a diesel power plant.</p>	02	05
6	<p><b>HYDRO-ELECTRIC POWER PLANT</b></p> <p>6.1 Define hydro-electric power plant.</p> <p>6.2 Describe the operating principle of hydro-electric power plant.</p> <p>6.3 Describe the various types of hydraulic turbine.</p> <p>6.4 Describe the various elements of hydro-electric power plant.</p> <p>6.5 Explain various types of draft tube used in hydro-electric power</p>	03	8

	<p>plant.</p> <p>6.6 Mention the factors to be considered in selecting the site of a hydro-electric power plant.</p> <p>6.7 Compare the hydro-electric power plant with others power plant.</p> <p>6.8 Solve problems related to hydro-electric power plant.</p>		
7	<p><b>NUCLEAR POWER PLANT</b></p> <p>7.1 Explain fission, fusion &amp; chain reaction.</p> <p>7.2 Describe the essential units of a nuclear plant.</p> <p>7.3 Describe the working principle of some common type nuclear reactor.</p> <p>7.4 Describe the method of waste disposal.</p> <p>7.5 Describe the safety measure of a nuclear power plant.</p> <p>7.6 Mention the advantages and disadvantages of nuclear power plant.</p> <p>7.7 Mention the factors to be considered in selecting the site of a nuclear power plant.</p> <p>7.8 Point out the maintenance and safety procedure of a nuclear power plant.</p> <p>7.9 Study the nuclear power plant established in Bangladesh.</p>	<b>02</b>	<b>05</b>
8	<p><b>RENEWABLE ENERGY SOURCES</b></p> <p>8.1 Discuss the potential renewable Energy sources in Bangladesh.</p> <p>8.2 Describe the promising practices of renewable energy in Bangladesh and worldwide.</p> <p>8.3 Discuss different types of solar cell.</p> <p>8.4 Explain the operating principle of solar cell.</p> <p>8.5 State the Common species recommended for biomass.</p> <p>8.6 State the environmental merits and de merits using renewable energy.</p>	<b>1</b>	<b>3</b>
9	<p><b>SOLAR POWER PLANT</b></p> <p>9.1 List general terms associated with solar energy.</p> <p>9.2 Describe solar radiation geometry, Declination, Hour Angle, Altitude angle, Incident angle, Zenith angle and Solar azimuth angle.</p> <p>9.2 Describe the Construction and working principle of typical flat plate collector and solar concentrate collector.</p> <p>9.3 Discuss the basic principles of Photovoltaic cell and fuel cell.</p> <p>9.4 Mention different types of Photovoltaic cell and Fuel cell.</p> <p>9.5 Describe the photo voltaic energy conversion system.</p> <p>9.6 Mention the applications of Photovoltaic cell and Fuel cell in</p>	<b>02</b>	<b>04</b>

	Residential, Community and central station. 9.7 Draw a Block diagram of solar power plant. 9.8 Describe the advantages and limitations of solar power plant.		
10	<b>WIND AND BIOMASS POWER PLANT</b> 10.1 Draw the schematic diagram of a wind mill power plant. 10.2 Mention the factors to be considered in selecting the site for the wind mill power plant. 10.3 Describe the principle of electricity generation with the help of wind energy. 10.4 Describe the Method for obtaining energy from biomass. 10.5 Classify biomass 10.6 State Gasified, Fixed bed and fluidized. 10.6 List Biomass digester. 10.7 Compare between biomass and conventional fuel.	<b>02</b>	<b>04</b>
11	<b>ECONOMICS OF POWER PLANT</b> 11.1 Define connected load, firm power, cold reserve, hot Reserve and spinning reserve. 11.2 Mention the Load curve, load duration curve and integrated duration curve. 11.3 Describe load factor, demand factor, diversity factor, plant capacity factor and plant use factor. 11.4 Describe the affecting factors the cost of power plant 11.5 Explain load dispatch, center-capacity and load scheduling. 11.6 Explain load management of power plant. 11.7 Solve the problems related to power plant economics.	<b>04</b>	<b>08</b>
	<b>Total</b>	<b>32</b>	<b>60</b>

### DETAILED SYLLABUS (PRACTICAL)

Sl.	Experiment Name with procedure	Class (3 Period)	Marks (Continuous)
1	<b>Observe boiler</b> 1.1 Identify different type of boiler. 1.2 Identify the boiler accessories and mounting. 1.3 Identify the pressure gauge, type of condenser. 1.4 Identify the fuel firing system of Boiler.	2	3

2	<b>Observe water turbine</b> 2.1 Identify the components of water turbine. 2.2 Identify the governing system of turbine. 2.3 Observe manufacture's specification of water turbine. 2.4 Operate the Pelton wheel at different speed.	2	4
3	<b>Observe the gas turbine model</b> 3.1 Identify the components of gas turbine. 3.2 Start the gas turbine model with compressed air. 3.3 Observe the operation of gas turbine.	1	2
4	<b>Observe the steam power plant</b> 4.1 Draw the schematic diagram of reheat cycle, regenerative cycle & reheat - regenerative cycle of steam power plant. 4.2 Identify vapor cycle components.	2	3
5	<b>Observe the diesel power plant</b> 5.1 Identify the components of diesel power plant. 5.2 Identify the cooling system of diesel power plant. 5.3 Identify the lubricating system of diesel engine. 5.4 Identify the starting system of diesel power plant.	1	2
6	<b>Portable power generation unit</b> 6.1 Disassemble a Portable power generation unit. 6.2 Identify the components of a Portable power generation unit. 6.3 Assemble a Portable power generation unit.	2	2
7	<b>Measure Voltage, Current for Series and Parallel Combination of Solar Panel</b> 7.1. Select the appropriate solar panel, Battery, Cable and multi-meter. 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.	1	2
8	<b>Observe Steam power plant</b> 8.1 Visit stream power plant 8.2 Observe steam power plant 8.3 Prepare a power point presentation regarding observation 8.4 Present power point	1	3
9	<b>Observe Gas turbine power plant</b>	1	2

	9.1 Visit Gas turbine power plant 9.2 Observe Gas turbine power plant 9.3 Prepare a power point presentation regarding observation 9.4 Present power point		
10	<b>Observe Hydro-electric/Nuclear/solar power plant</b> 8.1 Visit power plant 8.2 Observe power plant 8.3 Prepare a power point presentation regarding observation 8.4 Present power point	1	2
Total		16	25

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

SI	Item Name	Quantity
01	Fire tube boiler, Water tube boiler	3nos
02	Kaplan turbine model, francs turbine model, penton wheel turbine model.	3nos
03	Gas turbine model	As Necessary
04	Fire tube boiler, Water tube boiler	As Necessary
05	Diesel generator	As Necessary
06	Portable Diesel engine, Portable Petrol engine, battery	3nos (each)
07	Ammeter, Voltmeter, Ohm meter, AVO meter, Multimeter Wattmeter	As Necessary

**RECOMMENDED BOOKS:**

SI	Book Name	Writer Name	Publisher Name & Edition
1.	Power Plant Engineering	G.R. Nagpal	Khanna Publisher
2.	Power Plant Engineering	P.K. Nag	Tata McGraw-Hill-India Third Edition
3.	Power Plant Engineering	R.K. RAJPUT	Laxmi Publications (P) Ltd

4.	Power Plant Engineering	BLACK & VEATCH	Kluwer Academic Publishers
5.	Power plant Technology	M.M. El-Wakil	McGraw-Hill
6.	Principles of Power Systems	V.K Mehta Rohit Mehta	S. Chand Publications Fourth Revised Edition
7.	Power Plant Engineering	Dr. Mohis Varma	
8.	Power Plant Engineering	F. T. Moore	

**WEBSITE REFERENCES:**

Sl	Web Link	Remarks
01	<a href="http://www.youtube.com">www.youtube.com</a>	Search here with topics
03	<a href="http://www.google.com">www.google.com</a>	Search here with topics