Gujarat Council of Vocational Training
Gandhinagar

1. Name of Course : **Power Plant Mechanical Technician**

N.C.O. No. for Skill Covered: 841.90

(Please refer National Classification of Occupations – 2004 available on www.dget.nic.in)

2. Engineering or Non-engineering: **Engineering**

3. No. of Students per Batch: 20

4. Duration in Hours: 1092 Hours (@7 hours a day)

5. Duration in Month: 6 Months
   Practical: 24 hours/week
   Theory: 18 hours/week

6. Examination Scheme:

No.	Name of Subject	Maximum Marks	Minimum Marks required for Passing (excluding sessional)
1	Theory	100	40
2	Practical	300	180
	Total	400	220

7. Entry Qualification for Trainee:

Minimum entry qualification (Essential):	10th Standard + ITI (Fitter) or 10th Standard + 3 year experience in plant maintenance
Desirable :	-

8. Minimum Qualification for Trainer:

Minimum entry qualification (Essential):	Diploma/Digree in Mechanical Engineering
Desirable :	Experience in Power Plant Operation/Maintenance

power plant Mechanical Technician

8. Minimum Qualification for Trainer:

Minimum entry qualification (Essential):	Diploma in Engineering
Desirable :	Experience in Power Plant Operation/Maintenance

9. Syllabus Committee Members:

SN	Name	Organization	Designation	Technical Qualification	Experience in Year	Signature
1	Ranen Kumar Roy	Adani Power Limited	Head Operation & Maintenance	B.sc, B.Tech.	32	
2	Abhay Tamhane	Adani Power Limited	Vice President Human Resources	B.A, M.S.W.	30	
3	Pramod Saxena	Adani Power Limited	Associate Vice President,	B.E Electrical.	30	
4	Sunil Kumar	Adani Power Limited	Associate General Manager, Technical Training	B.Tech Production Engineering.	23	
5	Nischal Ravani	Adani Power Limited	Dy, Manager	B.A, LL.B, M.S.W.	15	
6	Jayantilala p Chotai	Industrial Training Institute	Principal ITI Bhuj/ Mundra	Diploma Mechanical.	34	

10. Terminal Skill of Trainee: (Should be well defined and having reference to NCO)

(Trainee after successful completion of training will have following skills...

- Ability to perform mechanical maintenance in any area of a power plant.

11. Approximate cost of Tools /Equipment's Machinery for starting one batch of the Course :

Nil. For practical training facility of the power plant (industry partner) will be used

Reference Year

Gujarat Council of Vocational Training

9. Syllabus Committee Members:

SN	Name	Organization	Designation	Technical Qualification	Experience in Year	Signature
1						
2						
3						
4						
5						

10. Terminal Skill of Trainee: (Should be well defined and having reference to NCO)

(Trainee after successful completion of training, will have following skills...

- Ability to perform mechanical maintenance in any area of a power plant.

11. Approximate cost of Tools /Equipment Machinery for starting one batch of the Course:

Nil. For practical training facility of the power plant (industry partner) will be used

N/A

12. Area required for practical / Workshop for one batch:

AS ABOVE

13. Minimum Power connection required:

AS PER POWER PLANT

14.1 No. of items in Standard List of Machinery:

AS PER POWER PLANT

14.1.1 Page No. From___-____ to __-_____

14.2 No. of items in Standard List of Shop outfit:

AS PER POWER PLANT

14.2.1 Page No. from __-__ to __-___

14.3 No. of items in Standard List of Trainee Tool-Kit:

N/A

14.3.1 Page No. from __-__ to __-__

********** FOR OFFICIAL USE **********

Approved by GCVT on : 28.7.2016

Syllabus implemented w.e.f admission session : Next session

Revision History:

1. Revision No. ..... Revision Date .....
2. Revision No. ..... Revision Date .....
3. Revision No. ..... Revision Date .....

Syllabus for Power Plant Mechanical Technician

Summary:

Sr. No	Program Description	Duration (in Hours)		Total (Days)
		Class	Practical / Plant Visits	
1.	Safety: Scaffolding , Rigging , Crane Operation	45.5	24.5	70
2	Power Plant Familiarization	91	84	175
3	Refresher Module	31.5	17.5	49
4.	Power plant Maintenance	238	462	700
5.	Personality Development	56	0	56
6.	Periodic / final assessment	42	0	42
	Total	**504**	**588**	**1092**

General Guidelines:

1. Personality development course will be spread over the six months – half day class every fortnight.
2. Periodic assessment of the students will be done weekly/fortnightly – it would be through written test / practical / viva. This will carry 30% weight for the final grade.
3. Final assessment would be done through written test and practical which will carry 70% weight.

Course Breakup:

Sr. No.	Program Description	Duration (in Hours)	
		Class	Practical / Plant Visits
01	**Safety : Scaffolding , Rigging , Crane Operation**		
1.1	**Safety**		
	I. Workplace Hazards A. General Industrial Hazards 1. Precautions/Countermeasures 2. Personal Protective Equipment B. Power Plant Hazards 1. Precautions/Countermeasures 2. Personal Protective Equipment C. Mechanical Work Hazards 1. Precautions/Countermeasures 2. Use of Personal Protective Equipment Sound levels Ear protection	7	
	II. Role of Safety Department in company	3.5	
	III. Emergency Response A. Types of Emergencies B. Initial Responders C. Response Teams D. Assembly Areas	3.5	
	IV. Safety at work place A. Safety in working at height B. Safety in confined space C. Working in dusty environment o Respiratory test o Full mask o Half mask D. Safety in electrical work E. Electrical Switchyard Operation & Maintenance Safety	7	
	IV. Energy Isolation for Maintenance A. Sources of Energy and Means of Isolation B. OSHA Lockout/Tag out Requirements C. Local Lockout/Tag out Requirements D. Blocking & Tagging (GIUE Examples in classroom & field) E. H. T. Permits	3.5	3.5

	D. Confined space permit requirements E. Hot work permit - When & Where? F. Work permit & Permit to work G. Grounding / Earthing procedures		
1.2	**Scaffolding**		
	I. Support Structure A. Capacity B. Bracing C. Pinning D. Components II. Access A. General B. Integral (Built-In) Access C. Ramps and Walkways D. Direct Access E. Erectors or Dismantlers III. Fall Protection A. Fall-Arrest Systems B. Guardrail Systems C. Erectors and Dismantlers IV. Platform A. Working Distance B. Overlap C. Brackets D. Capacity V. Falling Object Protection A. Workers on the Scaffold B. Workers Below VI. Keeping Upright A. Guys, Ties, and Braces B. Moving Scaffolds C. Weather VII. Case Reports From the OSHA Files A. Scaffold Collapses, Worker Injured B. Worker Falls From Collapsing Scaffold C. Improper Coupling Results in Two Deaths D. Improper Access Leads to Serious Injuries E. Employee Pulled Off Scaffold, Guardrails	7	7

	Saved Him F. Planking Not Overlapped, Causes Fatal Fall G. Worker Casualty During Scaffold Erection		
1.3	**Rigging**		
	I. Introduction to Rigging A. Rigging Safety B. Rigging Precautions C. Safe Working Loads II. Rigging Gear A. Wire Rope 1. Selection 2. Safety Factors 3. Inspection B. Slings 1. Synthetic Webbing Slings 2. Metal (Wire or Chain) Mesh Slings 3. Chain and Chain Mesh Slings 4. Wire Rope Slings 5. Sling Configurations 6. Sling Angles 7. Fiber Rope Slings 8. Sling Storage and Care C. Rigging Hardware 1. Hooks 2. Shackles 3. Eyebolts 4. Turn buckling 5. Links and Rings 6. Snatch Blocks D. Hoists 1. Chain Hand Hoists 2. Powered Hoists 3. Hoisting Equipment Safety Precautions 4. Testing requirement for hoist, chain pulley blocks, Slings & all other lifting devices E. Beams 1. Beam Clamps 2. Installation 3. Safe Use of Beam Clamps F. Trolleys 1. Installation 2. Removal	**7**	**14**

	3. Safe Use G. Jacks H. Rollers and Skids I. Winches 1. Major Components of Winches 2. Safety Precautions J. Cribbing III. Rigging Fundamentals A. Planning the Rigging Job 1. Weight of the Load 2. Center of Gravity 3. Dimensions of the Object and Travel Path 4. Hazards Associated With the Movement of the Object B. Selection of Equipment C. Using Proper Rigging Techniques D. Arm and Hand Signals for Rigging Operations E. Safe Operating Considerations IV. Moving and Manipulating Loads A. Drifting a Load B. Rotating a Load 1. One-Hook Rotating 2. Single-Sling Rotating 3. Two-Hook Rotating C. Tipping a Load D. Inverting a Load		
1.4	**Crane Operation**		
	I. EOT Cranes A. Structure and Function B. Major Components C. General Crane Control and Controls II. Mechanical Inspection Points A. Brake Mechanisms B. Trolley and End Stops C. Hoist – Couplings, Gearbox, and Drive Components, Bearings, Sheaves, Structure D. Bridge – Wheels, Bearings, Gearbox, and Drive components,	7	

	Structure E. Trolley - Wheels, Bearings, Gearbox, and Drive Components III . Crane movements & safety		
02	**Power Plant Familiarization**		
2.1	**Thermal Power Plant Operation**	7	7
2.2	**Boiler**		
	• Boiler Construction • Boiler Purge conditions • Boiler operation • SH & RH steam temp system • Drum, SH drains & vents, startup vents • Continuous blowdown / Emergency blowdown • Boiler draining & filling • SADC auto / manual operation • Slag pattern observation • Soot blower drains, inspection & operation • Floor operation readings & data logging overview • Coal bunker level reading • Wet coal operation – bunker poking, feeder poking. • Mill working • FD/ID/PA/Coal Mill Lube Oil System • Drum top & bottom temp control during start-up / shutdown • Draught, Air flow, Oxygen, CO, Nox & Sox control, it's limits.	21	21
2.3	**Turbine**		
	• Turbine Construction • CW, ACW & CCCW System. • Generator Water H2 filling • Generator Cooling Water System • Generator Seal oil System • Feed heaters system and commissioning procedure- drains & vents • Hot well Filling • Deaerator Filling • Cond working & Vacuum • Condensate storage tank min levels • Vacuum pump operation & maintenance • Condenser Charging method - drains & vents Turbine Lube Oil System	21	21

2.4	BOP		
	1. Fuel Handling Plant & CHP • Layout of coal & oil Handling Plants 2. Ash Handling Plant • Layout of Ash handling system • Operation of dry & wet ash Handling System 3. Air-Compressors / Driers / Air system • Control & service air system • Compressors control 4. Sea water intake plant 5. Cooling Towers & it Maintenance 8. Water treatment plant 9. R O Plant 10. Electro chlorination plant 11. Hydrogen Plant 12. D G Set O & M – regular checkup & starting operation 13. Service water system – Tanks, pumps, levels, operation	42	35
03	**Refresher Module**		
3.1	**Measuring & marking tools**		
	1. Measuring tools 2. Marking tools & methods 3. Cutting tools 4. Striking tools 5. Threads &fasteners 6. Precision tools, Vernier & Micrometers	3.5	3.5
3.2	**Bearing**		
	1. Bearing Basics & component 2. Bearing types 3. Bearing designation / numbering 4. Bearing Sleeves with sprung washer & lock nuts 5. Bearing Housing	7	
3.3	**Lubrication**		
	1. Oil ,types ,grades 2. Grease, types viscosity 3. Re-lubrication quantity 4. Re-lubrication interval	7	
3.4	**Different Gauges** – Pressure, Temp, Flow Meter, etc.	3.5	3.5

3.5	**Continuous Improvement** - Kaizen, Housekeeping-5S	3.5	3.5
3.6	**Condition Monitoring**		
	1. Vibrations - cause & remedies 2. Alignment & Balancing 3. Laser alignment 4. Thermography overview 5. Wear Debris Analysis overview	7	7
04	**Power plant Maintenance**		
4.1	**Boiler**		
	1. Boiler Insulation details * Insulating materials & it applications * Water walls, SH & RH, Pent house insulation. * Convection / Second pass insulation * Flue Gas ducts from economizer to chimney insulation details * Insulation of steam & water lines, drains & vents, Soot blowers etc. 2. Boilers tube failure cause & remedies. 3. Pressure relief valves – location & settings	14	28
4.2	Boiler Maintenance • Oil gun tip replacement • Boiler damper adjustment • Sight glass removal, cleaning • Pressure part orientation • Feeder level bar adjustment	14	28
4.3	**Hydraulics** 1. Hydraulic couplings & Scoop controls 2. Hydro vectors & Ejectors	14	21
4.4	**Welding skills**		
	• Welding Safety • Oxyacetylene Welding Equipment • Arc Welding Equipment • Welding Techniques • Avoiding Weld Faults • Welding Symbols • Oxygen Cutting • Cold welding techniques • Dissimilar metal welding • Preheating requirements • Post weld heat treatment • Use & selection of welding rods • Use of cutting rods	7	21

	• Cast iron welding • Brazing & silver soldering • Hot tapping		
4.5	**General Maintenance** • Use of maintenance hand tools e.g. extractors, pullers, drift, master flat etc. • Use of precision measuring instruments. • Fit parts together in set order using nuts, bolts, screws and pins etc. with necessary wrenches, spanners and other special tools. • Standard pipe thread, join pipes and make pipe assembly. Recondition thread by tap. • Mounting and dismounting of pulleys and gears on shafts. • Alignment of brackets and shafts. • Reaming holes for proper assembly. • Removal of broken taps. • Hand lapping practice. • Fabrication of special fixture required for machine maintenance. • Removing of broken studs from machine parts. • Removal and mounting of pulleys, gears, in the shaft. • Replacement of / repairing of bolts. • Practice of scraping on machine slides, machine beds, plain bearing etc. • Checking and repairing of broken and worn out gears, shafts, pulleys, flanges. Etc.	28	42
4.6	**Lubrication** Friction – its effect, methods of reducing friction, use of bearing. Coolants – different types and uses, cooling system. Lubrication and lubricants – methods of lubrication, need an use, qualities of good lubricants, viscosity, techniques of selection, type of lubrication oil and greases – their rating, commercial names and uses.	7	14
4.7	**Bearings** Different types, their application and dimensional relationship with shaft's method of clamping and fitting lubrication of bearing, methods of mounting and dismounting, care maintenance, inspection of bearings.	14	21
4.8	**Machine foundations and alignment:** Dowling, Methods employed for installation and erection of machines. Location and excavation of foundations. Types of foundation. Method of installation of machines.	14	21

4.9	**Valves Maintenance:** Types of valves, construction, types of faults, Lapping procedures, Piping material, Pipe flanges & expansions devices, Types of joints, gland packing & gaskets, Perform dry and hydraulic test of valves.	14	28
4.10	**Fans Maintenance** Fan lubrication system, Alignment of fans with prime mover, Dismantling reassemble & alignment procedure.	14	28
4.11	**Ash & Dust Collection System Maintenance** Maintenance of dust collection & ash handling system, Excessive sand particles isolation procedure, Wear and tear of various components, Ash disposal line maintenance, Dismantling & assembling procedure.	14	28
4.12	**Air Compressors Maintenance** Clearance setting of piston & cylinder, Trouble shooting, Dismantling & assembling procedure , filter replacement , lube oil checking , receiver drains checking , instrument air drier silica gel checking & replacement.	14	28
4.13	**Pump Maintenance:** Dismantling procedure, Use of fixtures, Methods of measurements of worn-out parts, Repair methods, Assembly of pumps. Replacement of damaged glands and seals	14	28
4.14	**Maintenance of Heat Exchangers** Condenser tubes cleaning by High Pressure water Jetting, Acid cleaning of condenser tubes, Condenser hydraulic test, Condenser re-tubing, Feed heaters fault repairing, Heaters tube replacement, Ejector maintenance.	14	28
4.15	**Cooling Tower Maintenance** Components, Specific problems, Major maintenance/modifications, I D fan gear box overhauling.	14	28
4.16	**Mill Maintenance**	14	28
	• Maintenance of grinding rollers & bull ring segment • Maintenance of mill general assembly • Maintenance of mill planetary gear box • Maintenance of coal feeders • Maintenance of mill reject system		
4.17	**CHP Maintenance**	14	42
	• Construction & maintenance of crushers		

	• Construction of belt conveying system • Coal belt alignment, belt tension adjustment, • Construction & maintenance vibrators		
05	**Personality Development**	**56**	
	• Productivity / Quality • Communication • Written English • Team Work • Inter Personal Skill		
06	**Periodic / final Assessment**	**42**	