SYLLABUS OF SEMESTER SYSTEM
FOR THE TRADE OF

FITTER

SEMESTER PATTERN

Under

Craftsmen Training Scheme (CTS)
(Two years/Four Semesters)

Revised in
2014

By
Government of India
Ministry of Labour & Employment (DGE&T)

GENERAL INFORMATION

1. **Name of the Trade** **: FITTER**

2. **N.C.O. Code No.** : 842.10, 842.15

3. **Duration of Craftsmen Training:** Two years (Four semesters each of six months duration).

4. **Power norms** : 3.51 KW

5. **Space norms** : 88 Sq.mt.

6. **Entry Qualification** : Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent

7. **Trainees per unit** : 16 (Supernumeraries/ Ex-Trainee allowed: 5)

8a. **Qualification for Instructors** : Degree in Mechanical Engineering from recognized university with one year post qualification experience in the relevant field

OR

Diploma in Mechanical Engineering from recognized Board of Technical Education with two years post qualification experience in the relevant field

OR

NTC/NAC in the Trade of "Fitter" with 3 years post qualification experience in the relevant field.

8b. **Desirable qualification** : Preference will be given to a candidate with Craft Instructor Certificate (CIC) in **Fitter Trade**.

Note:

(i) Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.

(ii) Instructor qualification for WCS and E.D, as per the training manual.

Distribution of training on Hourly basis:

Total hours /week	Trade practical	Trade theory	Work shop Cal. &Sc.	Engg. Drawing	Employability skills	Extra curricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

COURSE INFORMATION

1. Introduction:

- This course is meant for the candidates who aspire to become a professional fitter.

2. Terminal Competency/Deliverables:

After successful completion of this course the trainee shall be able to perform the following skills with proper sequence.

1. The trainees can work in the industry as semi-skilled fitter.
2. The trainee can work in the field of pipe fitting, lathe, drilling, welding, Inspection & measurement, general fitting work observing safety precautions.
3. The trainees can work on Dismantle & assemble of various valves, test the accuracy of Machine tools.
4. Perform simple repair on machinery, dovetail slides and assemble with location dowel pins, stud and bolts.
5. Prepare snap gauge for checking diameters to an accuracy of ± 0.02 mm
6. Handle different type of Fire extinguishers

3. Employment opportunities:

On successful completion of this course, the candidates shall be gainfully employed in the following industries:

1. Production & Manufacturing industries.
2. Structural Fabrication like bridges, Roof structures, Building & construction.
3. Automobile and allied industries
4. Service industries like road transportation and Railways.
5. Ship building and repair
6. Infrastructure and defence organizations
7. In public sector industries like BHEL, BEML, NTPC, etc and private industries in India & abroad.
8. Self employment

4. Further learning pathways:

- On successful completion of the course trainees can pursue Apprenticeship training in the reputed Industries / Organizations.
- On successful completion of the course trainees can opt for Diploma course (Lateral entry).
- On successful completion of the course trainees can opt for CITS course.

SYLLABUS FOR THE TRADE OF FITTER

First Semester

(Semester Code no. FTR - 01)

Duration : Six Month

Week No.	Trade Practical	Trade Theory
1.	Importance of trade training, List of tools & Machinery used in the trade. Health & Safety: Introduction to safety equipments and their uses. Introduction of first aid, operation of Electrical mains. **Occupational Safety & Health Importance of housekeeping & good shop floor practices.** Health, Safety and Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipments(PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Use of Fire extinguishers.	Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. **Soft Skills: its importance and Job area after completion of training.** Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure.
2.	Identification of tools & equipments as per desired specifications for marking & sawing. Selection of material as per application Visual inspection of raw material for rusting, scaling, corrosion etc., Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions, sawing different types of metals of different sections.	Linear measurements- its units, dividers, calipers, hermaphrodite, centre punch, dot punch, their description and uses of different types of hammers. Description, use and care of 'V' Blocks, marking off table.
3.	Filing Channel, Parallel. Filing- Flat and square (Rough finish). Filing practice, surface filing, marking of straight and parallel lines with odd leg calipers and steel rule, marking practice with dividers, odd leg calipers and steel rule (circles, arcs, parallel lines).	Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws. Files- specifications, description, materials, grades, cuts, file elements, uses. Measuring standards (English, Metric Units), angular measurements, subdivisions, try square, ordinary depth gauge, protractor- description, uses and cares.
4.	Marking off straight lines and arcs using	Marking off and layout tools, dividers,

	scribing block and dividers, chipping flat surfaces along a marked line.	scribing block, odd leg calipers, punches- description, classification, material, care & maintenance.
5.	Marking, filing, filing square, use of tri-square.	Calipers- types, material, constructional details, uses, care & maintenance of cold chisels- materials, types, cutting angles.
6&7	Marking according to simple blue prints for locating, position of holes, scribing lines on chalked surfaces with marking tools, finding center of round bar with the help of 'V' block and marking block. Joining straight line to an arc.	Marking media, marking blue, Prussian blue, red lead, chalk and their special application, description. Use, care and maintenance of scribing block.
8.	Chipping, Chip slots & oils grooves (Straight). Filing flat, square, and parallel to an accuracy of 0.5mm. Chip curve along a line-mark out, key ways at various angles & cut key ways.	Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types and uses, workshop surface plate- their uses, accuracy, care and maintenance. Types of files- convexing, taper, needle, care and maintenance of files, various types of keys, allowable clearances & tapers, types, uses of key pullers.
9.	File thin metal to an accuracy of 0.5 mm. Chip & chamfer, grooving and slotting	Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity.
10.	Saw along a straight line, curved line, on different sections of metal. Straight saw on thick section, M.S. angle and pipes.	Power Saw ,band saw, Circular saw machines used for metal sections cutting
11.	File steps and finish with smooth file accuracy ± 0.25 mm. File and saw on M.S. Square and pipe.	Micrometer- outside and inside – principle, constructional features, parts graduation, leading, use and care. Micrometer depth gauge, parts, graduation, leading, use and care. Digital micrometer.
12.	File radius along a marked line (Convex & concave) & match. Chip sheet metal (shearing). Chip step and file.	Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital vernier caliper.
13.	Mark off and drill through holes, drill and tap on M.S. flat, Punch letter and number (letter punch and number punch), use of different punches.	Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size.
14.	**Revision & Test** (Two days) Prepare forge. Fire for heating metals. Forge a square rod from round stock. Judge the forging temperature of various metals.	**Revision & Test** Safety precautions to be observed in a smith shop, forge - necessity, description uses, fuel used for heating, bellows blowers, description and uses

15.	Forge M.S. round rod to square Forge flat chisel, grind.	Anvil and swage blocks. Description and uses. Forging tools- hammers- band and sledge, description and uses. Chisels, set hammers, flatters, hardier, fuller swage & uses. Measuring and checking tools- steel rule, brass rule, calipers, try square, description and uses. General idea about the main operations performed in a forging shop such as upsetting drawing, twisting, bending, punching, drilling, and welding.
16.	Forge – punches, screw drivers, chisels, grind them to shape and heat treat to requirement, bending metals to angles, curves & twisting, Preparation of brackets.	Metallurgical and metal working processes such as Heat treatment, various heat treatment methods -normalizing, annealing, hardening, case hardening and tempering. Power hammer – construction, features, method of operating and uses.
17.	Marking of straight lines, circles, profiles and various geometrical shapes and cutting the sheets with snips. Marking out of simple development, marking out for flaps for soldering and sweating.	Safety precautions to be observed in a sheet metal workshop, sheet and sizes, Commercial sizes and various types of metal sheets, coated sheets and their uses as per BIS specifications.
18-19.	Make various joints: wiring, hemming, soldering and brazing, form locked, grooved and knocked up single hem straight and curved edges form double hemming,. Punch holes-using hollow and solid punches. Do lap and butt joints.	Marking and measuring tools, wing compass, Prick punch, tin man's square tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools, Soldering iron, types, specifications, uses. Trammel- description, parts, uses. Hand grooves- specifications and uses.
20.	Bend sheet metal into various curvature form, wired edges- straight and curves, fold sheet metal at angle using stakes. Bend sheet metal to various curvatures. Make simple Square, container with wired edge and fix handle.	Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection & application. Wired edges -
21.	Make square tray with square soldered corner Practice in soft soldering and silver soldering.	Solders-composition of various types of solders, and their heating media of soldering iron, fluxes types, selection and application-joints
22.	Make riveted lap and butt joint. Make funnel as per development and solder joints. Drilling for riveting. Riveting with as many types of rivet as available, use of counter sunk head rivets.	Rivets-Tin man's rivets types, sizes, and selection for various works. Riveting tools, dolly snaps description and uses. Method of riveting, shearing machine- description, parts and uses.
23-25	**Revision**	
26	**Examination**	

SYLLABUS FOR THE TRADE OF FITTER

Second Semester

(Semester Code no. FTR - 02)

Duration : Six Month

Week No.	Trade Practical	Trade Theory
1	Welding - Striking and maintaining arc, laying Straight-line bead.	Safety-importance of safety and general precautions observed in a welding shop. Precautions in electric and gas welding. (Before, during, after) Introduction to safety equipment and their uses. Machines and accessories, welding transformer, welding generators,
2	Making square, butt joint and 'T' fillet joint-gas and arc. Do setting up of flames, fusion runs with and without filler rod, and gas	Hand tools: Hammers, welding description, types and uses, description, principle, method of operating, carbon dioxide welding. H.P. welding equipment: description, principle, method of operating L.P. welding equipment: description, principle, method of operating. Types of Joints-Butt and fillet as per BIS SP: 46-1988 specifications. Gases and gas cylinder description, kinds, main difference and uses.
3	Make butt weld and corner, fillet in arc welding	Setting up parameters for arc welding machines-selection of Welding electrodes
4	Gas cutting of MS plates	Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses.
5	Mark off and drill through holes, drill on M.S. flat, file radius and profile to suit gauge.	Drill- material, types, (Taper shank, straight shank) parts and sizes. Drill angle-cutting angle for different materials, cutting speed feed. R.P.M. for different materials. Drill holding devices- material, construction and their uses.
6	Counter sink, counter bore and ream split	Counter sink, counter bore and spot facing-tools

	fit (three piece fitting). Form internal threads with taps to standard size (through holes and blind holes) – Drill through hole and tap drill blind hole and tap, prepare studs and bolt.	and nomenclature, Reamer- material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure. Screw threads: terminology, parts, types and their uses. Screw pitch gauge: material parts and uses. Taps British standard (B.S.W., B.S.F., B.A. & B.S.P.) and metric /BIS (course and fine) material, parts (shank body, flute, cutting edge). Tap wrench: material, parts, types (solid & adjustable types) and their uses removal of broken tap, studs (tap stud extractor).
7	Form external threads with dies to standard size. Prepare nuts and match with bolts.	Dies: British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses.
8	Step fit, angular fit, file and make angle, surfaces (Bevel gauge accuracy 1 degree) make simple open and sliding fits.	Drill troubles: causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Drill kinds: Fraction, metric, letters and numbers, grinding of drill.
9	Enlarge hole and increase internal dia. File cylindrical surfaces. Make open fitting of curved profiles.	Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Bench grinder parts and use-radius gauge, fillet gauge, material, construction, parts function and metric, different dimensions, convex and concave uses care and maintenance.
10	Make the circles by binding previously drilled hole. Test angular match up.	Radius gauge, feeler gauge, hole gauge, and their uses.
11	Inside square fit, make combined open and sliding fit, straight sides ‘T’ fit.	Interchangeability: Necessity in Engg, field definition, BIS. Definition, types of limit, terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero line, tolerance zone Different standard systems of fits and limits. British standard system, BIS system
12	File fit- combined, open angular and sliding sides. File internal angles 30 minutes accuracy open, angular fit.	Method of expressing tolerance as per BIS Fits : Definition, types description of each with sketch .Vernier height gauge : material construction, parts, graduations (English & Metric) uses, care and maintenance, Pig Iron : manufacturing process (by using)Blast furnace types, of pig Iron , properties and uses.
13	Make sliding fit with angles other than $90^{o,}$ sliding fit with an angle.	Cast Iron: manufacturing process by using (cupola furnace) types, properties and uses. Wrought iron- : manufacturing process (Fuddling and Astor process) properties and uses. Steel: manufacturing process plain carbon steels, types, properties and uses.
14	Make simple bracket by bending and twisting of non-ferrous metal. Drill small holes (2mm) Drill holes on sheet metal, bend short for round bracket.	Non-ferrous metals (copper, aluminum, tin, lead, zinc) properties and uses.

15	Counter sink, counter bore and ream split fit (three piece fitting).	Counter sink, counter bore and spot facing-tools and nomenclature, Reamer- material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure.
16	Scrap on flat surfaces, scrap on curved surfaces and scrap surface parallels and test. Make & assemble, sliding flats, plain surfaces. Check for blue math of bearing surfaces- both flat and curved surfaces by witworth method.	Simple scraper- cir., flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces)
17	File and fit combined radius and angular surface (accuracy ± 0.5 mm), angular and radius fit. Locate accurate holes. Make accurate hole for stud fit. Fasten mechanical components / sub assemblies together using screws, bolts and collars using hand tools.	Vernier micrometer, material, parts, graduation, use, care and maintenance. Calibration of measuring instruments Introduction to mechanical fasteners and its uses. Screw thread micrometer: Construction, graduation and use.
18	Cutting threads using dies. Make sliding fits assembly with parallel and angular mating surface. (± 0.04 mm)	Dial test indicator, construction, parts, material, graduation, Method of use,. Care and maintenance. Digital dial indicator. Comparators-measurement of quality in the cylinder bores.
19 & 20	Simple repair work, simple assembly of machine parts from blue prints. Rectify possible assembly faults during assembly.	Preventive maintenance-objective and function of P.M., section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of handbooks and reference table. Possible causes for assembly failures and remedies.
21	Assemble simple fitting using dowel pins and tap screw assembly using torque wrench.	Assembling techniques such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torquing. Dowel pins: material, construction, types, accuracy and uses.
22-23	**Implant training** / Project work (work in a team)	
24-25	**Revision**	
26	**Examination**	

SYLLABUS FOR THE TRADE OF FITTER

Third Semester

(Semester Code no. FTR - 03)

Duration: Six Month

Week No.	Trade Practical	Trade Theory
01	True job on four jaw chuck using knife tool, face both the ends for holding between centers, Using roughing tool parallel turn ± 0.1 mm. Measure the diameter using outside caliper and steel rule.	Safely precautions to be observed while working on a lathe, Lathe specifications, and constructional features. Lathe main parts descriptions- bed, head stock, carriage, tail stock, feeding and thread cutting mechanisms. Holding of job between centers, works with catch plate, dog, simple description of a facing and roughing tool and their applications.
02	Lathe operations- the facing, parting and form tools, plain turn, step turn, holding job in three jaw chuck- deburr, chamfer-corner, round, the ends, Shoulder turn: square, filleted, beveled undercut shoulder, turning-filleted under cut, square beveled.	Lathe cutting tools- Brief study of the nomenclature of Lathe cutting tools and necessity of correct grinding, solid and tipped, throw away type tools, cutting speed and feed and comparison for H.S.S., carbide tools. Use of coolants and lubricants.
03	Cut grooves- square, round 'V' groove, Make a mandrel-turn diameter to sizes. Knurl the job.	Chucks and chucking the independent four-jaw chuck. Reversible features of jaws, the back plate, Method of clearing the thread of the chuck-mounting and dismounting, chucks, chucking true, face plate, drilling - method of holding drills in the tail stock, Boring tools and enlargement of holes.
04	Bore holes –spot face, pilot drill, enlarge hole, using boring tools, make a bush step bore-cut recess, turn hole diameter to sizes. Turn taper (internal and external). Turn taper pins. Turn standard tapers to suit with gauge.	General turning operations- parallel or straight, turning. Stepped turning, grooving, and shape of tools for the above operations. Appropriate method of holding the tool on tool post or tool rest, Knurling: - tools description, grade, uses, speed and feed, coolant for knurling, speed, feed calculation. Taper – definition, use and method of expressing tapers. Standard tapers-taper, calculations morse taper.

05	Threading practice by using cut threads using taps, dies on lathe by hand, 'V' thread – external. Prepare a nut and match with the bolt.	Screw thread definition – uses and application. Terminology of screw threads, square, worm, buttress, acme (non standard-screw threads),Principle of cutting screw thread in centre lathe – principle of chasing the screw thread – use of centre gauge, setting tool for cutting internal and external threads, use of screw pitch gauge for checking the screw thread.
06	Assembly sliding for using keys and dowel pin and screw, ± 0.02 mm accuracy on plain surface. Testing of sliding fitting job, scrap on two flat surfaces and curved surfaces.	Screws: material, different types (inch & metric), uses Testing scraped surfaces: ordinary surfaces without a master plate.
07	File & fit angular mating surface plain within an accuracy of ± 0.02 mm & angular 15 minutes angular fitting.	Special files: types (pillar, Dread naught, Barrow, warding) description.
08	Drill through and blind holes at an angle, using swivel table of drilling machine, Precision drilling, reaming and tapping. Test-Job..	System of drill size, Fractional size: number, letter and metric. Templates and gauges-Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses.
09	Dovetailed fitting, radius fitting.	Description and uses of gauge-types (feeler, screw, pitch, radius, wire gauge),
10	File and fit, combined fit with straight, angular surface with ± 0.02 mm accuracy, hexagonal fitting. Check adherence to specification and quality standards using equipments like Vernier calipers, micrometers etc.,	Slip gauge: Necessity of using, classification & accuracy, set of blocks (English and Metric). Details of slip gauge. Metric sets 46: 103: 112. Wringing and building up of slip gauge and care and maintenance. Application of slip gauges for measuring, Sine bar-Principle, application & specification. Procedure to check adherence to specification and quality standards.
11	Drilling and reaming, small dia. holes to accuracy correct location for fitting Make male and female fitting parts, drill and ream holes not less than 12.7 mm.	Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use.
12	Sliding fitting, Diamond fitting, Lapping flat surfaces using lapping plate.	Lapping: Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish. Equipment for tasting surfaces quality – dimensional tolerances of surface finish.

13	Stepped keyed fitting-test job. Lapping holes and cylindrical surfaces.	Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance.
14	Making a snap gauge for checking a dia of 10 ± 0.02 mm.	. Manufacture: The name and types of gauge commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization
15	Scrape angular mating surface, scrape on internal surface.	Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row.
16	Practice in dovetail fitting assembly and dowel pins and cap screws assembly. **Industrial visit.**	Roller and needle bearings: Types of roller bearing. Description & use of each **Industrial visit.**
17	Preparation of gap gauges.	Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, teflon polyamide (nylon).
18	Dovetail and Dowel pin assembly, scraps cylindrical bore.	Method of fitting ball and roller bearings
19	Scrapping cylindrical bore and to make a fit-make a cotter jib assembly.	Bearing metals – types, composition and uses, lubricants purpose of using different types, description and uses of each type
20	Scrapping cylindrical taper bore, check taper angle with sine bar, check in per angle (flat) with sine bar.	Hardening and tempering, purpose of each method, tempering colour chart.
21	Preparation of centre, squares, drills gauges. File and fit straight and angular surfaces internally Identify different ferrous metals by spark test	Annealing and normalising, purpose of each method.
22-23	**Implant training** / Project work (work in a team)	
24-25	**Revision**	
26	**Examination**	

SYLLABUS FOR THE TRADE OF FITTER

Fourth Semester

(Semester Code no. FTR - 04)

Duration : Six Month

Week No.	Trade Practical	Trade Theory
01.	'H' fitting-	Case hardening and carburising and its methods, process of carburising (solid, liquid and gas).
02.	Exercises on lapping of gauges (hand lapping only) Hand reams and fit taper pin, drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts.	Solder and soldering: Introduction-types of solder and flux. Method of soldering, Hard solder- Introduction, types and method of brazing. Production of gauges, templates and jigs. The objective of importance for preparing interchangeable components.
03.	Simple jigs and fixtures for drilling. Prepare a 'V' block and a clamp. Marking out as per Blue print, drilling, straight and curve filing. Threading with die, cutting slot, and cutting internal threads with taps, making an adjustable spanner.	Drilling jig-constructional features, types and uses. Fixtures-Constructional features, types and uses.
04.	Flaring of pipes and pipe joints, Cutting & Threading of pipe length. Fitting of pipes as per sketch. Conditions used for pipe work to be followed. Bending of pipes- cold and hot.	Pipes and pipe fitting- commonly used pipes. Pipe schedule and standard sizes. Pipe bending methods. Use of bending fixture, pipe threads- Std. Pipe threads Die and Tap, pipe vices.
05.	Practice-dismantling & assembling – globe valves sluice valves, stop cocks, seat valves and non-return valve, fitting of pipes and testing for leakage.	Standard pipefitting-. Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and house hold taps and pipe work. Use of tools such as pipe cutters, pipe wrenches, pipe dies, and tap, pipe bending machine etc.
06.	Practice in handling Fire extinguishers of different types, refilling of extinguishers.	Fire precautions-causes and types of fires, precautions against out break of fire. Fire Extinguishers-types and use.
07.	Marking detail includes male & female screw cutting, male and female fitting parts. Making and tempering springs.	Working material with finished surface as aluminium, duralumin, stainless steel, the importance of keeping the work free from rust and corrosion. The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments and provide a pleasing finish as chromium silver plating and nickel plating, and galvanising.
08.	Exercises on finished material as aluminium and stainless steel,	Aluminium and its alloys. Uses, advantages and disadvantages, weight and strength as compared

	marking out, cutting to size, drilling etc. without damage to surface of finished articles.	with steel.
09.	Marking out for angular outlines, filing and fitting the inserts into gaps. Making a simple drilling jig, Marking out, filing to line, drilling and tapping brass and copper jobs.	Tapers on keys and cotters permissible by various standards. Discuss non-ferrous metals as brass, phosphor bronze, gunmetal, copper, aluminium etc. Their composition and purposes where and why used, advantages for specific purposes, surface wearing properties of bronze and brass.
10.	Complete exercises covering the assembly of parts working to detail and arrangement – Drawings, Dismantling and mounting of pulleys. Making replacing damaged keys. Repairing damaged gears and mounting. Repair & replacement of belts.	Power transmission elements. The object of belts, their sizes and specifications, materials of which the belts are made, selection of the type of belts with the consideration of weather, load and tension methods of joining leather belts. Vee belts and their advantages and disadvantages, Use of commercial belts, dressing and resin creep and slipping, calculation.
11.	Complete exercises covering the assembly of parts working to details and arrangements as per drawings. Dismantling and mounting of pulleys. Making, replacing damaged keys. Repairing damaged gears and mounting them on shafts.	Power transmissions, coupling types-flange coupling,-Hooks coupling-universal coupling and their different uses.
12.	More difficult work in marking out including tangents, templates involving use of vernier protractor.	Pulleys-types-solid, split and 'V' belt pulleys, standard calculation for determining size crowning of faces-loose and fast pulleys-jockey pulley. Types of drives-open and cross belt drives. The geometrical explanation of the belt drivers at an angle.
13.	Fitting of dovetail slides.	Power transmission –by gears, most common form spur gear, set names of some essential parts of the set-The pitch circles, Diametral pitch, velocity ratio of a gear set, Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing, pinion and rack, worm gearing, velocity ration of worm gearing. Repair to gear teeth by building up and dovetail method.
14.	Male and female dovetail fitting repairs to geared teeth. Repair of broken gear tooth by stud. Repair broker gear teeth by dovetail.	Method or fixing geared wheels for various purpose drives. General cause of the wear and tear of the toothed wheels and their remedies, method of fitting spiral gears, helical gears, bevel gears, worm and worm wheels in relation to required drive. Care and maintenance of gears.

15 - 16	Marking out on the round sections for geometrical shaped fittings. Finishing and fitting to size, checking up the faces for universality.	Lubrication and lubricants- Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. How a film of oil is formed in journal. Bearings, method of lubrication-gravity feed, force (pressure) feed, splash lubrication. Cutting lubricants and coolants: Soluble off soaps, suds-paraffin, soda water, common lubricating oils and their commercial names, selection of lubricants. Chains, wire ropes and clutches for power transmission. Their types and brief description. Discuss the various rivets shape and form of heads, riveting tools for drawing up the importance of correct head size. The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.
17	Prepare different types of documentation as per industrial need by different methods of recording information.	Importance of Technical English terms used in industry –(in simple definition only)Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards.
18 & 19	Inspection of Machine tools. Accuracy testing of Machine tools.	Installation, maintenance and overhaul of machinery and engineering equipment and Hydraulics & pneumatic symbols & exercise. Hydraulics pneumatic circuits. Clutch: Type, positive clutch (straight tooth type, angular tooth type) .
20.	Study of power transmission system in machine tools.	Washers-Types and calculation of washer sizes. The making of joints and fitting packing. The use of lifting appliances, extractor presses and their use. Practical method of obtaining mechanical advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts.
21.	Simple repair of machinery, making of packing gaskets, use of hollow punches, extractor ,drifts, various types of hammers and spanners, etc. Practicing, making various knots, correct loading of slings, correct and safe removal of parts. Erect sample machines.	Foundation bolt: types (rag, Lewis cotter bolt) description of each erection tools, pulley block, crow bar, spirit level, Plumb bob, pipe 2 X 4', wire rope, manila rope, wooden block.
22-23	**Implant training** / Project work (work in a team)	
24-25	**Revision**	
26	**Examination**	

TRADE: FITTER

LIST OF TOOLS & EQUIPMENTS

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity
1	Steel Rule 15 cm with metric graduation	21 nos.
2	Try Square 10 cm blade.	21 nos.
3	Caliper inside 15 cm spring.	21 nos.
4	Caliper 15 cm hermaphrodite	21 nos.
5	Caliper outside 15 cm spring	21 nos.
6	Divider 15 cm spring	21 nos.
7	Straight Scriber 15 cm.	21 nos.
8	Centre Punch 10 cm	21 nos.
9	Screw driver 15 cm	21 nos.
10	Chisel cold flat 10 cm	21 nos.
11	Hammer ball peen 0.45 kg. With handle	21 nos.
12	Hammer ball peen 0.22 kg. With handle.	21 nos.
13	File flat 25 cm. second cut	21 nos.
14	File flat 25 cm. smooth	21 nos.
15	File half round second cut 15 cm.	21 nos.
16	Hacksaw frame fixed 30 cm.	21 nos.
17	Safety goggles.	21 nos.
18	Dot slot punch 10 cm.	21 nos.

B : Instruments & General Shop Outfit

Sl. No.	Name of the items	Quantity
19	Steel Rule 30 cm	4 nos.
20	Steel Rule 60 cm.	4 nos.
21	Straight edge 45 cm steel	2 nos.
22	Surface plate 45 x 45 cm CI / Granite.	2 nos.
23	Marking table 91 x 91 x 122 cm.	1 no.
24	Universal scribing block 22 cm.	2 nos.
25	V-Block pair 7 cm and 15 cm with clamps	2 nos.
26	Square adjustable 15 cm blade.	2 nos.
27	Angle plate 10 x 20 cm.	2 nos.
28	Spirit Level 15 cm metal	1 no.
29	Punch letter 3 mm set.	1 no.
30	Punch number set 3 mm.	1 no.
31	Punch hollow 6 mm to 19 set of 5	2 nos.
32	Punch round 3mm x 4 mm set of 2	2 nos.
33	Portable hand drill (Electric) 0 to 6 mm	2 nos.
34	Drill twist straight shank 1.5 to 12 mm by 0.5 mm	1 Set
35	Drill twist straight shank 8 mm to 15 mm by ½ mm	1 Set
36	Taps and dies complete set in box B.A	1 no.
37	Taps and dies complete set in box with-worth.	1 no.
38	Taps and dies complete set in box 3-18 mm set of 10	1 no.
39	File warding 15 cm smooth	4 nos.
40	File knife edge 15 cm smooth	4 nos.
41	File cut saw 15 cm smooth	4 nos.
42	File feather edge 15 cm smooth	4 nos.
43	File triangular 15 cm smooth	2 nos.
44	File round 20 cm second cut	8 nos.
45	File square 15 cm second cut	4 nos.
46	File square 25 cm second cut	4 nos.
47	Feeler gauge 10 blades	1 set
48	File triangular 20 cm second cut.	8 nos.
49	File flat 30 cm second cut.	8 nos.
50	File flat 20 cm bastard	8 nos.
51	File flat 30 cm bastard.	8 nos.
52	File Swiss type needle set of 12.	2 sets
53	File half round 25 cm second cut.	8 nos.
54	File half round 25 cm bastard.	4 nos.
55	File round 30 cm bastard.	4 nos.
56	File hand 15 cm second cut.	8 nos.
57	Card file.	8 nos.
58	Oil Stone 15 cm x 5 cm x 2.5 cm	4 nos.
59	Stone carborandum 15 cm x 5 cm x 5 cm x 4 cm.	2 nos.
60	Oil Can 0.25 liters.	2 nos.
61	Pliers combination 15 cm	2 nos.

62	Soldering Iron 350 gm.	2 nos.
63	Blow Lamp 0.50 liters.	2 nos.
64	Spanner D.E. 6 -26 mm set of 10 pcs.	8 nos.
65	Spanner adjustable 15 cm	2 nos.
66	Interchangeable ratchet socket set with a 12 mm driver, sized10-32 mm set of 18 socket & attachments.	1 set
67	Box spanner set 6-25 mm set of 8 with Tommy bar.	1 set
68	Glass magnifying 7 cm	2 nos.
69	Clamp toolmaker 5 cm and 7.5 cm set of 2.	2 nos.
70	Clamp “C” 5 cm	2 nos.
71	Clamp “C” 10 cm	2 nos.
72	Hand Reamer adjustable cover max 9 ,12,18mm – set of 3	1 set
73	Hand Reamer taper 4 -9mm set of 6 OR 4 -7 mm set of 4.	1 set
74	Reamer parallel 12 - 16mm set of 5.	1 no.
75	Scraper flat 15 cm.	8 nos.
76	Scraper triangular 15 cm	8 nos.
77	Scraper half round 15cm	8 nos.
78	Chisel cold 9 mm cross cut 9 mm diamond.	8 each
79	Chisel cold 19 mm flat	8 nos.
80	Chisel cold 9 mm round noze.	8 nos.
81	Stud Extractor EZY – out	2 nos.
82	Combination Set 30 cm.	2 nos.
83	Micrometer 0 – 25 mm outside.	2 nos.
84	Micrometer 25 – 50 mm outside.	3 nos.
85	Micrometer 50 –75 mm outside.	2 nos.
86	Micrometer inside 25 - 50 mm with extension rods.	1 no.
87	Vernier caliper 15 cm	1 no.
88	Vernier height gauges 30 cm.	1 no.
89	Vernier bevel protractor.	1 no.
90	Screw pitch gauge.	1 no.
91	Wire gauge, metric standard.	1 no.
92	Drill twist Taper Shank 12 mm to 25 mm x 1.5.	1 no.
93	Drill chuck 12 mm.	1 no.
94	Pipe wrench 40 cm	1 no.
95	Pipe vice 100mm	1 no.
96	Adjustable pipe tap set BSP with die set cover pipe size 15, 20, 25,32,38,50 mm.	1 no.
97	Wheel dresser (One for 4 units).	1 no.
98	Machine vice 10 cm.	1 no.
99	Machine vice 15 cm	1 no.
100	Sleeve drill Morse 0 - 1, 1 - 2, 2 - 3.	1 Set
101	Vice bench 12 cm jaws.	16 nos.
102	Vice leg 10 cm jaw.	2 nos.
103	Bench working 240 x 120 x 90 cm.	4 nos.

104	Almirah 180 x 90 x 45 cm.	2 nos.
105	Lockers with 6 drawers (standard size).	2 nos.
106	Metal rack 182 x 182 x 45 cm	1 no.
107	Instructor Table	1 no.
108	Instructor Chair	1 no.
109	Black board with easel.	1 no.
110	Fire extinguisher (For 4 Units)	2 nos.
111	Fire buckets.	2 nos.
112	Machine vice 100mm.	2 nos.
113	Wing compass 25.4 cm or 30 cm.	2 nos.
114	Hand hammer 1 kg. with handle.	2 nos.
115	Torque wrench (14 to 68 Nm)	1 no.

C : Tools for Allied Trade- Blacksmith & Sheet Metal Work

Sl. No.	Name of the items	Quantity
115	Hammer smith 2 kg. With handle.	2 nos.
116	Tongs roving 350mm.	2 nos.
117	Tongs fiat 350mm.	2 nos.
118	Smith's square 45 cm x 30 cm.	1 no.
119	Cold set rodded 25X200mm.	2 nos.
120	Hot set rodded 25X200mm.	1 no.
121	Swages top & bottom 12 mm /19	1 Each
122	Swage block 35 x 35 x 12 cm.	1 no.
123	Flatters (rodded) 55 mm square.	2 nos.
124	Fuller top & bottom 6 mm 9 mm (Pair).	2 nos.
125	Anvil 50 kg.	2 nos.
126	Anvil stand	2 nos.
127	Shovel.	2 nos.
128	Trammel 30cm.	1 no.
129	Rake.	2 nos.
130	Quenching tank (To be made in the Institute).	1 no.
131	Pocker.	2 nos.
132	Hardle.	2 nos.
133	Leather apron.	2 nos.
134	Prick punch	2 nos.
135	Mallet.	2 nos.
136	Snips straight 25 cm.	2 nos.
137	Setting hammers with handle.	2 nos.
138	Planishing hammer.	2 nos.
139	Snip bent 25 cm.	2 nos.
140	Stake hatchet.	2 nos.
141	Stake grooving.	2 nos.
142	Gauge imperial sheet.	1 no.

The specifications of the items in the above list have been given in Metric Units. The items which are available in the market nearest of the specification as mentioned above, if not available as prescribed should be procured Measuring instruments such as steel rule which are graduated both English and Metric Units may be procured, if available.

D : Modified list of tools for the 3rd and 4th semester for fitter trade.

Sl. No.	Name of the Tools & Equipment	Quantity
*1.	Slip Gauge as Johnson metric set.	1 Set
2.	Carbide Wear Block 1 mm – 2 mm.	2 each
*3.	Gauge snap Go and Not Go 25 to 50 mm by 5mm. Set of 6 pcs.	1 Set
*4.	Gauge plug single 3 ended 5 to 55 by 5 mm. Set of 11 pcs.	1 Set
**5.	Gauge telescopic upto 150 mm.	1 no.
6.	Dial test indicator .01 mm on stand	1 no.
7.	Sine bar 125 mm.	1 no.
8.	Sine bar 250 mm.	1 no.
9.	Lathe tools H.S.S. tipped set.	2 nos.
10.	Lathe tools bit 6 mm x 75 mm.	4 nos.
11.	Lathe tools bit 8 mm x 75 mm.	4 nos.
12.	Lathe tools bit 10 mm x 85mm.	4 nos.
13.	Arm strong type tool bit holder R.H.	2 nos.
14.	Arm strong type tool bit holder L.H.	2 nos.
15.	Arm strong type tool bit holder straight.	2 nos.
16.	Stilson wrenches 25 cm	2 nos.
17.	Pipe cutter 6 mm to 50 mm wheel type.	1 no.
18.	Pipe bender spool type up to 25 mm. with stand manually operated.	1 no.
19.	Adjustable pipe chain tonge to take pipes up to 300 mm.	1 no.
20.	Adjustable spanner 38 cm long.	1 no.
**21.	Dial vernier caliper 0 – 200 mm LCO 0.05 mm. (Universal type).	1 no.
**22.	Screw thread micrometer with interchangeable 0-25mm. Pitch anvils for checking metric threads 60.	1 no.
23.	Depth micrometer 0-25 mm. 0.01 mm.	1 no.
**24.	Vernier caliper 0-150 mm. L.C. 0.02 mm.	1 no.
**25.	Digital Micrometer 0 – 25 mm outside. L.C. 0.001 mm.	1 no.
**26.	Comparators stand with dial indicator LC 0.01mm.	1 no.
27.	Engineer's try square (knife-edge) 150 mm blade.	1 no.
**28	Surface roughness comparison plates N1-N12 grade	1 Set
29	Digital Vernier caliper 0-150 mm. L.C. 0.001 mm.(Optional)	1no.

E : General Machinery Installations –

Sl. No.	Name & Description of Machines	Quantity
*1.	SS and SC centre lathe (all geared) with minimum specification as: Centre height 150 mm and centre distance 1000 mm along with 3 & 4 jaw chucks, auto feed system, safety guard, taper turning attachment, motorized coolant system, lighting arrangement & standard accessories.	2 Nos.
2	Drilling machine pillar sensitive 0-20 mm cap with swivel table motorised with chuck & key.	1 no.
3	Drilling machine bench sensitive 0-12 mm cap motorised with chuck and key.	2 nos.
4	Forge portable hand blower 38 cm to 45 cm.	1 no.
5	D.E. pedestal Grinding machine with 200mm diameter wheels rough and smooth with twist drill grinding attachment.	1 no.

Note: - (*) No additional number of items are required to be provided up to four batches of trainees i.e. two batches in the first shift and two in the second shift.

(**) Only one number need be provided in each I.T.I. irrespective of No. of Units.

F : List of additional tools for allied trade in welding

Sl. No.	Name & Description of Machines	Quantity
1.	Transformer welding set 150 amps. – continuous welding current, with all accessories and electrode holder	1 Set
2.	Welder cable to carry 200 amps. With flexible rubber cover	20 Meter
3.	Lungs for cable	12 Nos.
4.	Earth clamps.	2 Nos.
5.	Arc welding table (all metal top) 122 cm X 12 cm X 60 cm with positioner.	1 No.
6.	Oxy – acetylene gas welding set equipment with hoses, regulator and other accessories.	1 Set.
7.	Gas welding table with positioner	1 No
8.	Welding torch tips of different sizes	1 Set
9.	Gas lighter.	2 Nos
10.	Trolley for gas cylinders.	1 No
11.	Chipping hammer.	2 Nos
12.	Gloves (Leather)	2 Pairs
13.	Leather apron.	2 Nos
14.	Spindle key for cylinder valve.	2 Nos.
15.	Welding torches 5 to 10 nozzles.	1 Set.
16	Welding goggles	4 Pairs.
17.	Welding helmet with coloured glass	2 Nos.
18.	Tip cleaner	10 Sets.

Note: - Those additional items are to be provided for the Allied Trade Training where the welding trade does not exist.

LIST OF TRADE COMMITTEE MEMBERS

Sl. No.	Name & Designation Sh/Mr./Ms.	Organization	Mentor Council Designation
Members of Sector Mentor council			
1.	A. D. Shahane, Vice-President, (Corporate Trg.)	Larsen & Tourbo Ltd., Mumbai:400001	Chairman
2.	Dr. P.K.Jain, Professor	IIT, Roorkee, Roorkee-247667, Uttarakhand	Member
3.	N. Ramakrishnan, Professor	IIT Gandhinagar, Gujarat-382424	Member
4.	Dr. P.V.Rao, Professor	IIT Delhi, New Delhi-110016	Member
5.	Dr. Debdas Roy, Asstt. Professor	NIFFT, Hatia, Ranchi-834003, Jharkhand	Member
6.	Dr. Anil Kumar Singh, Professor	NIFFT, Hatia, Ranchi-834003, Jharkhand	Member
7.	Dr. P.P.Bandyopadhyay Professor	IIT Kharagpur, Kharagpur-721302, West Bengal	Member
8.	Dr. P.K.Ray, Professor	IIT Kharagpur, Kharagpur-721302, West Bengal	Member
9.	S. S. Maity, MD	Central Tool Room & Training Centre (CTTC), Bhubaneswar	Member
10.	Dr. Ramesh Babu N, Professor	IIT Madras, Chennai	Member
11.	R.K. Sridharan, Manager/HRDC	Bharat Heavy Electricals Ltd, Ranipet, Tamil Nadu	Member
12.	N. Krishna Murthy Principal Scientific Officer	CQA(Heavy Vehicles), DGQA, Chennai, Tamil Nadu	Member
13.	Sunil Khodke Training Manager	Bobst India Pvt. Ltd., Pune	Member
14.	Ajay Dhuri	TATA Motors, Pune	Member
15.	Uday Apte	TATA Motors, Pune	Member
16.	H B Jagadeesh, Sr. Manager	HMT, Bengaluru	Member
17.	K Venugopal Director & COO	NTTF, Peenya, Bengaluru	Member
18.	B.A.Damahe, Principal L&T Institute of Technology	L&T Institute of Technology, Mumbai	Member
19.	Lakshmanan. R Senior Manager	BOSCH Ltd., Bengaluru	Member
20.	R C Agnihotri Principal	Indo- Swiss Training Centre Chandigarh, 160030	Member
Mentor			
21.	Sunil Kumar Gupta (Director)	DGET HQ, New Delhi.	Mentor
Members of Core Group			
22.	N. Nath. (ADT)	CSTARI, Kolkata	Co-ordinator
23.	H.Charles (TO)	NIMI, Chennai.	Member

24.	Sukhdev Singh (JDT)	ATI Kanpur	Team Leader
25.	Ravi Pandey (V.I)	ATI Kanpur	Member
26.	A.K. Nasakar (T.O)	ATI Kolkata	Member
27.	Samir Sarkar (T.O)	ATI Kolkata	Member
28.	J. Ram Eswara Rao (T.O)	RDAT Hyderabad	Member
29.	T.G. Kadam (T.O)	ATI Mumbai	Member
30.	K. Mahendar (DDT)	ATI Chennai	Member
31.	Shrikant S Sonnavane (T.O)	ATI Mumbai	Member
32.	K. Nagasrinivas (DDT)	ATI Hyderabad	Member
33.	G.N. Eswarappa (DDT)	FTI Bangalore	Member
34.	G. Govindan, Sr. Draughtsman	ATI Chennai	Member
35.	M.N.Renukaradhya, Dy.Director/Principal Grade I.,	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
36.	B.V.Venkatesh Reddy. JTO	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
37.	N.M.Kajale, Principal,	Govt. ITI Velhe, Distt: Pune, Maharashtra	Member
38.	Subrata Polley, Instructor	ITI Howrah Homes, West Bengal	Member
39.	VINOD KUMAR.R Sr.Instructor	Govt.ITI Dhanuvachapuram Trivendrum, Dist., Kerala	Member
40.	M. Anbalagan, B.E., Assistant Training Officer	Govt. ITI Coimbatore, Tamil Nadu	Member
41.	K. Lakshmi Narayanan, T.O.	DET, Tamil Nadu	Member
Other industry representatives			
42.	Venugopal Parvatikar	Skill Sonics, Bangalore	Member
43.	Venkata Dasari	Skill Sonics, Bangalore	Member
44.	Srihari, D	CADEM Tech. Pvt. Ltd., Bengaluru	Member
45.	Dasarathi.G.V.	CADEM Tech. Pvt. Ltd., Bengaluru	Member
46.	L.R.S.Mani	Ohm Shakti Industries, Bengaluru	Member

SYLLABUS OF SEMESTER SYSTEM

FOR THE TRADE OF

E L E C T R I C I A N

UNDER
CRAFTSMEN TRAINING SCHEME (CTS)
(Two Years / Four Semesters)

Redesigned in
2014

By
Government of India
Ministry of Labour and Employment (DGET)

GENERAL INFORMATION

1.	Name of the Trade	: ELECTRICIAN
2.	N.C.O. Code No.	: 7137.10(851.10), 7241.20(851.30)
3.	Duration of Craftsmen Training	: 2 Years (4 Semesters having duration of six months each)
4.	Entry Qualification	: Passed 10th class examination under 10+2 System of education with Science and Mathematics or its equivalent.
5.	Unit Strength (No. Of student)	: 16
6.	Space norms	: 98 Sq. metres.
7.	Power norms	: 5.2 KW (for two units in one shift)
8.	Instructors Qualification	: Degree in Electrical / Electrical and Electronics Engineering from recognized Engineering College/ university with one year experience in the relevant field **OR** Diploma in Electrical / Electrical and Electronics Engineering from recognized board of technical education with two years experience in the relevant field **OR** 10th class examination and NTC/NAC in the Trade of "Electrician" With 3 years' post qualification experience in the relevant field. and one year Craftsman instructor training under CITS

LIST TRADE EXPERTS, CORE GROUP MEMBERS & MENTOR COUNCIL MEMBERS

(S/Shri)

1.	Dr. S.P. Gupta	Professor, IIT Roorkee, (CHAIRMAN)
2.	R.N. Bandopadhyay	Director, CSTARI, Kolkatta
3.	R. Senthil Kumar	Director, ATI, Chennai
4.	A VenkateshwaraRao	Joint Director, ATI, Chennai
5.	P. Saibaba	Joint Director, ATI, Chennai
6.	K.L. Kuli	Joint Director, CSTARI, Kolkatta
7.	K. Srininvasa Rao	Joint Director, CSTARI, Kolkatta
8.	M. Thamizharasan	Joint Director, CSTARI, Kolkatta
9.	S. Mathivanan	Dy Director, ATI, Chennai, (TEAM LEADER)
10.	Amrit Pal Singh	Dy. Director, DGET, New Delhi.(MENTOR)
11.	B.N. Sridhar	Dy Director, FTI, Bangalore
12.	Ketan Patel	Dy Director, RDAT, Mumbai
13.	B. Ravi	Dy Director, CTI, Chennai
14.	A.S. Parihar	Dy Director, RDAT, Kolkata
15.	Nirmalya Nath	Asst Director, CSTARI, Kolkatta
16.	Parveen Kumar	Asst Director, ATI-EPI, Hyderabad
17.	C.C. Jose	Trg Officer, ATI, Chennai
18.	L.M. Pharikal	Trg Officer, ATI, Kolkata
19.	M. Asokan	Trg Officer, CTI, Chennai
20.	Mohan Raj	Trg Officer, NIMI Chennai
21.	U.K. Mishra	Trg Officer, ATI, Mumbai
22.	C.M. Diggewadi	Trg Officer, RDAT, Mumbai
23.	A. Chakraborthy	Trg Officer, CSTARI, Kolkatta
24.	T.K. Ghosh	Trg Officer, CSTARI, Kolkatta
25.	Prasad U.M.	Voc Instructor, MITI, Calicut
26.	Gabriel Pradeep A.P.	JTO. Govt ITI, Hosur Road, Bangalore
27.	Latha	JTO. Govt ITI, Hosur Road, Bangalore
28.	D. Viswanathan	ATO. Govt ITI, North Chennai
29.	B. Navaneedhan	ATO, ITI. North Chennai
30.	R . Rajasekar	ATO, ITI, Ambattur, Chennai
31.	K. Amaresan	ATO, Govt ITI, Guindy, Chennai
32.	Dr.P. Mahanto	Professor, IIT, Guwahati
33.	K.K. Seth	Ex. Director, BHEL, Noida
34.	N. Chattopadhyay	Sr. DGM, BHEL, Kolkatta
35.	Surendu Adhikari	OTIS Elevator Co. India Ltd, Kolkatta
36.	K. Raju	Consultant- Energy Area, ASCI, Hyderabad
37.	Ravi G Deshmukh	Certified Energy Auditor, PPS Energy solutions, Pune
38.	R. Thiruppathi	JTS, IIT, Madras, Chennai
39.	M.N. Krishnamurthy	Retd. Ex Engineer, TNEB, Chennai
40.	S. Kirubanandam	Asst. Ex Engineer, TANTRANSCO, Chennai
41.	R. Kasi,	Asst. Ex Engineer, TANTRANSCO, Chennai
42.	L.R. Sundarajan	Jr. Works Manager, Heavy vehicles factory
43.	B.S. Sudheendara	Consultant, VI micro systems pvt ltd, Chennai.
44.	S. Ganesh	Manager, L&T , Chennai
45.	G. Neethimani	Vice principal, Rane engine valves ltd, Chennai.

COURSE INFORMATION – Electrical Power Sector - (TRADE: ELECTRICIAN)

1. INTRODUCTION:

- This course is meant for the candidate who aspires to become Technician in ELECTRICIAN.
- This course curriculum is revised and re-structured to make the First Semester Syllabus common for all the Trades under "POWER SECTOR"

2. TERMINAL COMPETENCY:

At the end of the course the trainee shall be able to

- carryout Installation, maintenance & repair works of Electrical AC, DC, machinery, lighting circuits, domestic appliances and equipments used in domestic and industries
- read and interpret the blue print reading (Electrical layout Drawing as per BIS specification & standards)
- carry out Domestic and Industrial wiring, Earthing System
- test electrical wiring installation , locate and rectify the faults by using megger and Earth tester
- Make and solder the wire joints, wires on PCB and do de-soldering technique
- Use of electrical instrument(analog/digital) like voltmeter, Ammeter, Wattmeter, Energy Meter, Wheatstone bridge, oscilloscope, Earth tester, Tong tester, etc to measure to different electrical quantities
- Armature winding, single & three phase motor winding and small transformer winding
- Operate, maintain and test the switch gears, circuit breakers, relays and transformer
- Identify and maintain the Power Generating stations (conventional and non-convential), Transmission and distribution system protecting devices.
- Construct & test semiconductor devices
- Practice on using fitting carpentry and sheet metal tools.
- Carried out break down, over hauling, routine & preventive maintenance of electrical machines and equipments

3. EMPLOYMENT OPPORTUNITIES

- All state Electricity Boards and departments
- Public sectors, MNC, Private and Govt. Industries
- License Certificate for self employment
- Wiring Contractors
- Huge job opportunities in power generation, transmission, distribution station.
- Huge abroad job opportunities

4. FURTHER LEARNING PATHWAYS

- Apprentice training in designated trade
- Craft Instructor certificate course
- License Certificate in all State Electricity Boards
- Diploma in Electrical Engineering

Syllabus for the Trade of "*Electricial Power sector*" *(TRADE: ELECTRICIAN)*
Duration : Six Month

First Semester
Semester Code: EL: SEM I

Week No.	Trade Practical	Trade Theory
1	Implementation in the shop floor of the various safety measures. Visit to the different sections of the Institute. Demonstration on elementary first aid. Artificial Respiration Practice on use of fire extinguishers.	**Occupational Safety and Health** Basic safety introduction, Personal protection. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution and personal safety message. Use of Fire extinguishers. Visit and observation of sections. Various safety measures involved in the Industry. Elementary first Aid. Concept of Standard.
2	Demonstration of Trade hand tools. Identification of simple types- screws, nuts & bolts, chassis, clamps, rivets etc. Use, care and maintenance of various hand tools.	Identification of Trade-Hand tools- Specifications , Uses and their care maintenance.
3	Practice in using cutting pliers, screw drivers, etc. skinning the cables and jointing practice on single strand and multi stranded conductor. Demonstration and Practice on bare conductors joints-- such as Britannia, straight, T, Western union Joints	Fundamental of electricity. Electron theory- free electron, Fundamental terms, definitions, units and effects of electric current Explanation, Definition and properties of conductors, insulators and semi-conductors. Wires/cable & its specification. Types of wire joints & uses.
4	Practice on soldering & Brazing. Measurement of Resistance. Determination of specific Resistance.	Solders, flux and soldering technique. Brazing . Types & properties of resistors Specific Resistance.
5-6	Verification of Ohm's Law, Verification of Kirchoff's Laws. Verification of laws of series, parallel and combination circuits.	**Ohm's Law -** Simple electrical circuits and problems. **Resistors -**Laws of Resistance. Series, parallel and combination circuits.

	Verification of open circuit and closed circuit network. Measuring unknown resistance using different methods- a) Using Wheatstone Bridge b) By voltage drop method. Experiment to demonstrate the variation of resistance of a metal with the change in temperature.	**Kirchoff's** Laws and applications. Wheatstone bridge principle and its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance.
7	Demonstration and identification of types of cables. Demonstration and practice on using standard wire gauge & micrometer. Practice on crimping thimbles, Lugs.	Introduction of National Electrical Code Voltage grading of different types of Insulators, Temp. Rise permissible. Types of wires and cables standard wire gauge. Specification of wires and Cables-insulation and voltage grades -Low , medium and high voltage Precautions in using various types of cables / Ferrules
8	Identification and use of wiring accessories Practice on installation and overhauling common electrical accessories. Fixing of switches, holder plugs etc. in wooden/PVC/ Metallic boards.	Common Electrical wiring Accessories, their specifications in line with NEC - Explanation of switches, lamp holders, plugs and sockets. Developments of domestic circuits, Alarm & switches, Use & specification of Fire alarm, MCB, ELCB, MCCB.
9 - 11	Grouping of Dry cells for a specified voltage and current. Practice on Battery Charging, Preparation of battery charging, Testing of cells, Installation of batteries, Charging of batteries by different methods. Charging of a Lead acid cell, filling of electrolytes-Testing of charging .checking of discharged and fully charged battery. Care and maintenance of Batteries	Chemical effect of electric current- Principle of electrolysis. Faraday's Law of electrolysis. Basic principles of Electroplating and Electro chemical equivalents. Explanation of Anodes and Cathodes. Cells - Primary & Secondary Lead acid cell-description, methods of charging-Precautions to be taken & testing equipment, Ni-cadmium & Lithium cell, Cathodic protection. Electroplating, Anodising. Different types of lead acid cells. Application of battery/cell in Inverter, Battery Charger, UPS, etc. Lead Acid cell, general defects and remedies. Nickel Alkali Cell-description charging. Power and capacity of cells. Efficiency of cells. Rechargeable dry cell, description advantages and disadvantages. Care and maintenance of cells

		Grouping of cells of specified voltage and current, Sealed Maintenance free Batteries, Solar battery.
12-13	ALLIED TRADES: Marking use of chisels and hacksaw on flats, sheet metal filing practice, filing true to line. Sawing and planning practice. Practice in using firmer chisel and preparing simple half lap joint.	Introduction of fitting trade. Safety precautions to be observed Description of files, hammers, chisels hacksaw frames and blades- their specification and grades. Care and maintenance of steel rule, try square and files. Marking tools description and use. Description of carpenter's common hand tools such as saws planes, chisels mallet claw hammer, marking, dividing and holding tools-their care and maintenance.
14	Drilling practice in hand drilling and power drilling machines. Grinding practice Practice in using taps and dies, threading hexagonal and square nuts etc. cutting external threads on stud and on pipes, riveting practice.	Types of drills description and drilling machines, proper use, care and maintenance. Description of taps and dies, types of rivets and riveted joints. Use of thread gauge.
15	Practice in using snips, marking and cutting of straight and curved pieces in sheet metals. Bending the edges of sheets metals. Riveting practice in sheet metal. Practice in making different joints in sheet metal in soldering the joints.	Description of marking and cutting tools such as snubs shears punches and other tools like hammers, mallets, etc. used by sheet metal workers. Different types soldering materials, fluxes and process. Types of different soldering irons and their proper uses. Use of different bench tools used by sheet metal worker.
16-17	Trace the magnetic field. Assembly / winding of a simple electro magnet. Use of magnetic compass. Identification of different types of Capacitors. Charging and discharging of capacitor, Testing of Capacitors using DC voltage and lamp.	**Magnetism** - classification of magnets, methods of magnetising, magnetic materials. Properties, care and maintenance. Para and Diamagnetism and Ferro magnetic materials. Principle of electro-magnetism, Maxwell's corkscrew rule, Fleming's left and right hand rules, Magnetic field of current carrying conductors, loop and solenoid. MMF, Flux density, reluctance. B.H. curve, Hysteresis, Eddy current. Principle of electro-magnetic Induction, Faraday's Law, Lenz's Law. Electrostatics: Capacitor- Different types, functions and uses.
18-19	Determine the characteristics of RL,RC and	**Alternating Current -**Comparison and Advantages D.C and A.C. Related terms

	RLC in A.C. Circuits both in series and parallel. Experiment on poly phase circuits. Current, voltage, power and power facor measurement in single & poly- phase circuits. Measurement of energy in single and poly-phase circuits. - Use of phase sequence meter.	frequency Instantaneous value, R.M.S. value Average value, Peak factor, form factor. Generation of sine wave, phase and phase difference. Inductive and Capacitive reactance Impedance (Z), power factor (p.f). Active and Reactive power, Simple problems on A.C. circuits, single phase and three-phase system etc. Problems on A.C. circuits. Power consumption in series and parallel, P.F. etc. Concept three-phase Star and Delta connection. Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load.
20	**Practice on Earthing** - different methods of earthing. Measurement of Earth resistance by earth tester. Testing of Earth Leakage by ELCB and relay.	**Earthing** - Principle of different methods of earthing. i.e. Pipe, Plate, etc Importance of Earthing. Improving of earth resistance Earth Leakage circuit breaker (ELCB). In absence of latest revision in respective BIS provision for Earthing it is recommended to follow IEC guidelines.
21	Determine the resistance by Colour coding Identification of active/passive components. **Diodes**-symbol - Tests - Construct & Test Half wave rectifier ckt. Full wave rectifier ckt. Bridge rectifier ckt.	**Basic electronics**- Semiconductor energy level, atomic structure 'P' type and 'N' type. Type of materials –P-N-junction. Classification of Diodes – Reverse and Forward Bias, Heat sink. Specification of Diode PIV rating. Explanation and importance of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit. Filter circuits-passive filter.
22-23	Industrial visit / project work	
24-25	NCVT EXAMINATION	
26	Semester Gap	

CTS First Semester: (Electrician, Wireman, Electroplater, Lift & Escalator Mech.)

LIST OF TOOLS and EQUIPMENT

A. TRAINEES TOOL KIT FOR 16 TRAINEES +1 INSTRUCTOR

TOOL KIT			
Sl. No.	***Name of the items***	***Quantity***	***Remarks***
1	Steel Tape, 15 m length	17 Nos.	**Sr. No. 1 to 18 tool kits to be Common for 1 to 4 semesters.**
2	Plier Insulated, 150 mm	17 Nos.	
3	Plier Side Cutting, 150 mm	17 Nos.	
4	Screw Driver, 100 mm	17 Nos.	
5	Screw Driver, 150 mm	17 Nos.	
6	Electrician Connector, screw driver insulated handle thin stem, 100 mm	17 Nos.	
7	Heavy Duty Screw Driver , 200 mm	17 Nos.	
8	Electrician Screw Driver thin stem insulated handle, 250 mm	17 Nos.	
9	Punch Centre , 150 mm X 9 mm	17 Nos.	
10	Knife Double Bladed Electrician	17 Nos.	
11	Neon Tester	17 Nos.	
12	Steel Rule 300 mm	17 Nos.	
13	Hammer, cross peen with handle	17 Nos.	
14	Hammer, ball peen With handle	17 Nos.	
15	Gimlet 6 mm.	17 Nos.	
16	Bradawl	17 Nos.	
17	Scriber (Knurled centre position)	17 Nos.	
18	Pincer 150 mm	17 Nos.	
NOTE: *For 2nd Unit of the Trade, only Trainees Tool Kit (from Sl No- 1 to 18) is required additionally.*			

B. SHOP TOOLS, INSTRUMENTS and MACHINERY

1	C- Clamp 200 mm, 150 mm and 100 mm	2 Nos each	**Common for 1 to 4 semesters.**
2	Spanner Adjustable 150 mm,300mm	2 Nos each	
3	Blow lamp 0.5 ltr	1	
4	Melting Pot	1	
5	Ladel	1No	
6	Chisel Cold firmer 25 mm X 200 mm	2	**Common for 1 to 4 semesters.**
7	Chisel 25 mm and 6 mm	2 Nos each	
8	Hand Drill Machine	1	
9	Portable Electric Drill Machine 6 mm capacity	1	
10	Pillar Electric Drill Machine 12 mm capacity	1	
11	Allen Key	1 set	
12	Oil Can 0.12 ltr	1	
13	Grease Gun	1 No	
14	Out Side Micrometer	2	**Common**

			for 1 to 3 semesters.
15	Motorised Bench Grinder	1	**Common for 1 to 4 semesters.**
16	Rawl plug tool and bit	2 set	
17	Pully Puller	2	
18	Bearing Puller	2	
19	Pipe vice	4	
20	Thermometer 0 to 100 deg Centigrade	1 No.	
21	Scissors blade 150 mm	4 Nos.	Common for 1 & 3 semesters
22	Crimping Tool	2 sets	**Common for 1 to 4 semesters.**
23	Wire stripper 20 cm	2 Nos.	
24	Chisel Cold flat 12 mm	2 Nos.	
25	Mallet hard wood 0.50 kg	4 Nos.	
26	Hammer Extractor type 0.40 kg	4 Nos.	
27	Hacksaw frame 200 mm 300 mm adjustable	2 Nos. each	
28	Try Square 150 mm blade	4 Nos.	**Common for 1 to 3 semesters.**
29	Outside and Inside Divider Calliper	2 Nos. each	
30	Pliers flat nose 150 mm	4 Nos.	**Common for 1 to 4 semesters.**
31	Pliers round nose 100 mm	4 Nos.	
32	Tweezers 100 mm	4 Nos.	
33	Snip Straight and Bent 150 mm	2 Nos. each	**Common for 1, & 3 semesters.**
34	D.E. metric Spanner	2 Nos.	**Common for 1 to 4 semesters.**
35	Drill hand brace	4 Nos.	
36	Drill S.S. Twist block 2 mm, 5 mm 6 mm set of 3	4 Set	
37	Plane, smoothing cutters 50 mm	2 Nos. each	
38	Gauge, wire imperial	2 Nos.	
39	File flat 200 mm 2nd cut	8 Nos.	
40	File half round 200 mm 2nd cut	4 Nos.	
41	File round 200 mm 2nd cut	4 Nos.	
42	File flat 150 mm rough	4 Nos.	
43	File flat 250 mm bastard	4 Nos.	
44	File flat 250 mm smooth	4 Nos.	
45	File Rasp, half round 200 mm bastard	4 Nos.	
46	Soldering Iron 25 watt, 65 watt, 125 watt	2 Nos. each	
47	Copper bit soldering iron 0.25 kg.	2 Nos.	
48	Desoldering Gun	4 Nos.	**Common for 1 to 4 semesters.**
49	Hand Vice 50 mm jaw	4 Nos.	
50	Table Vice 100 mm jaw	8 Nos.	

51	Pipe Cutter to cut pipes upto 5 cm. dia	4 Nos.	**Common for 1, to 3 semesters.**
52	Pipe Cutter to cut pipes above 5 cm dia	2 Nos.	
53	Stock and Die set for 20 mm to 50 mm G.I. pipe	1 set	
54	Stock and Dies conduit	1 No.	
55	Ohm Meter; Series Type & Shunt Type	2 Nos. each	**Common for 1 to 4 semesters.**
56	Multi Meter (analog) 0 to 1000 M Ohms, 2.5 to 500 V	2 Nos.	
57	Digital Multi Meter	6 Nos.	
58	A.C. Voltmeter M.I. 0 –500V A.C	1 No.	
59	Milli Voltmeter centre zero 100 – 0 – 100 m volt	1 No.	
60	D.C. Milli ammeter 0 -500m A	1 No.	
61	Ammeter MC 0-5 A, 0- 25 A	1 No. each	
62	A.C. Ammeter M.I. 0-5A, 0-25 A	1 No. each	
63	Kilo Wattmeter 0-1-3 kw	1 No.	
64	A.C. Energy Meter, Single phase 5 amp. Three Phase 15 amp	1 No. each	
65	Power Factor Meter	1 No.	
66	Frequency Meter	1 No.	
67	Flux meter	1 No.	
68	Wheat Stone Bridge with galvanometer and battery	1 No.	
69	Laboratory Type Induction Coil	1 No.	
70	DC Power Supply 0-30V, 2 amp	1 No.	**Common for 1, to 3 semesters.**
71	Rheostat 0 -1 Ohm, 5 Amp 0 -10 Ohm, 5 Amp 0- 25 Ohm, 1 Amp 0- 300 Ohm, 1 Amp	1 No. each	
72	1 Phase Variable Auto Transformer	1 No.	**Common for 1 to 4 semesters.**
73	Battery Charger	1 No.	
74	Hydrometer	1 No.	
75	Miniature Breaker 16 amp (Raw Material)	1 No.	**Common for 1 to 4 semesters.**
76	Working Bench 2.5 m x 1.20 m x 0.75 m	4 Nos.	
77	Fire Extinguisher CO_2, 2 KG	2 Nos.	
78	Fire Buckets	2 Nos.	
Note: The items which are available in the market nearest of the specification as mentioned above may be procured.			

FURNITURE :

Sl. No.	*Name of the items*	*Quantity*	*Remarks*
1	Instructor's table	1 No.	**Common for 1 to 4 semesters**
2	Instructor's chair	2 Nos.	
3	Metal Rack 100cm x 150cm x 45cm	4 Nos.	
4	Lockers with 16 drawers standard size	2 Nos.	
5	Almirah 2.5 m x 1.20 m x 0.5 m	1 No.	
6	Black board/white board	1 No.	

Syllabus for the Trade of "*Electrician*"

Duration : Six Month

Second Semester

Semester Code: ELE: SEM II

Week No.	Trade practical	Trade Theory
1-2	Different wave shapes of rectifiers and their values using C.R.O. Identification of terminals, construction & Testing of transistor. Assembly and testing of a single stage Amplifier and checking using an oscilloscope.	Working principle and uses of an oscilloscope. Explanation of principle of working of a transistor & configuration. Types of transistors & its application. Specification and rating of transistors. Explanation of transistor Amplifiers, Amplifiers. – class A,B and C Power amplifier
3-4	Measure Voltage, current & wave shape of oscillator using CRO. Simple circuits containing U.J.T. for triggering, FET as an amplifier and Power control circuits by S.C.R. and Diac, triac, I.G.B.T. Logic gates and circuits.	Explanation of oscillator-working principle Explanation of stages and types. Multivibrator – applications. Introduction of basic concept of ICs, U.J.T., F.E.T. Basic concept of power electronics devices e.g. S.C.R., Diac, Triac, power MOSFET, G.T.O and I.G.B.T. **Digital Electronics** -Binary numbers, logic gates and combinational circuits,
5-6	Practice in casing, Capping. Conduit wiring with minimum to more number of points. Use of two way switches. Testing of wiring installation by meggar. -Fixing of calling bells/buzzers. -Making of test boards & extension boards Identification & demonstration on conduits and accessories & their uses, cutting , threading & laying Installation, Testing, Maintenance and Repairing of wiring.	**Electric wirings**, I.E. rules. Types of wirings both domestic and industrial. Specifications for wiring. Grading of cables and current ratings. Principle of laying out in domestic wiring. Voltage drop concept. **Wiring system -** P.V.C., concealed system. Maintenance and Repairing data sheet preparation. Specifications, standards for conduits and accessories - Power Wiring - Control Wiring - Information Communication - Entertainment Wiring. Testing of wiring installation by meggar.
7	Application of fuses, relay, MCB, ELCB.	Study of Fuses, Relays, Miniature circuit breakers (MCB), ELCB, etc.

8-9	Identification of the parts of a D.C. machine. Connection of shunt Generators Voltages build up in DC Shunt Generator (OCC) Measurement of voltages, Demonstration on field excitation.	**D.C. Machines -** General concept of Electrical Machines. **Principle of D.C. generator.** Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring Brushes, Laminated core. Explanation of **D.C. Generators**-types, parts. **E.M.F**. equation-self excitation and separately excited Generators-Practical uses. Brief description of series, shunt and compound generators.
10-11	Connection of compound Generator, Voltage measurement, cumulative and differential –No Load and Load characteristics of Series, Shunt and Compound Generator. Controlling and protecting DC Generator. Practicing dismantling and assembling in D.C. Machine.	Explanation of Armature reaction, inter poles and their uses, connection of inter poles, Commutation. Losses & Efficiency of D.C.Generator, Parallel Operation of D.C.Generator. Application of D.C. generators. Care, Routine & preventive maintenance.
12-13	Identification of parts and terminals of DC motors. Connection, starting, running of DC motors using Starters. Characteristics curve of DC motors. Practical application of D.C. motors.	**DC Motors -** Terms used in D.C. motor-Torque, Brake Torque, speed, Back-e.m.f. etc. and their relations, Types of D.C.Motor. Starters used in D.C. motors Related problems Characteristics of D.C.Motor, Losses & Efficiency, Application of D.C. motors. Care, Routine & preventive maintenance.
14	Speed control of DC motors by voltage , field, armature & Word-Leonard system.	Types of speed control of DC motors in industry. Control system. AC-DC, DC-DC control.
15-18	Identification of types of transformers. Connection of transformers, Transformation ratio, OC (No-load) and SC (short circuit) tests,efficiencies of transformers, testing of transformer, parallel operation of transformer. Use of Current Transformer (C.T.) and Potential	Working principle of **Transformer**. classification C.T., P.T. Instrument and Auto Transformer(Variac), Construction, Single phase and Poly phase. E.M.F. equation, parallel operation of transformer, their connections. Regulation and efficiency. Type of Cooling for transformer. Protective devices. Specifications, simple problems on e.m.f. Equation, turn ratio, regulations and

	(Voltage) transformer (P.T.) Testing of single phase and Three Phase Transformers - Cleaning, maintenance, testing and changing of oil. Single and three phase connection.	efficiency. Special transformers. Transformer – Classification of transformer. Components, Auxiliary parts i.e. breather, Conservator, buchholze relay, other protective devices. Transformer oil testing and Tap changer (off load and on load). Dry type transformer. Bushings and termination.
19-21	Identify the type of Instruments. Use of **-P**MMC , MI meter, Multi-meter(Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter, Calibration of **-** Multi-meter Phase sequence meter, Digital Instruments, etc Calibration of Energy meter.	**Electrical Measuring Instruments -** -types, indicating types. Deflecting torque, Controlling torque and Damping torque , PMMC & MI meter (Ammeter, Voltmeter) -Range extension -Multimeter(Digital/Analog) -Wattmeter - P.F. meter - Energy meter (Digital/analog) –Insulation Tester (Megger), Earth tester. -Frequency meter -Phase Sequence meter -Multimeter –Analog and Digital -Tong tester -Techometer.
22-23	Industrial visit / project work	
24-25	NCVT EXAMINATION	
26	Semester Gap	

CTS Second Semester: Electrician

SHOP TOOLS, INSTRUMENTS and MACHINERY

Sl. No.	*Name of the items*	*Quantity*	*Remarks*
1	Tachometer	1 No.	**Common for 2 to 4 semesters**
2	Current Transformer 415 Volt,50 Hz, CT Ratio 150 / 5 Amp, 5VA	1 No.	
3	Potential Transformer 415 Volt,50Hz, PT Ratio 11KV/ 110V, 10VA	1 No.	
4	Growler	1 No.	**Common for 2 to 4 semesters**
5	Tong Tester / Clamp Meter 0 – 100 amp. AC	1 No.	
6	Megger 500 volts	1 No.	
7	Contactor & auxiliary contacts 3 phase, 440volt, 16amp (Raw Material)	1 No. each	
8	Contactor & auxiliary contacts 3 phase, 440 volt, 32 amp. (Raw Material)	1 No. each	
9	Limit Switch (Raw Material)	1 No.	
10	Rotary Switch 16 A (Raw Material)	1 No.	
11	Load Bank 5 KW(Lamp / heater Type)	1 No.	
12	Brake Test arrangement with two spring balance 0 to 25 kg rating	1 No.	**Common for 2 & 3 semesters**
13	Knife Switch DPDT fitted with fuse terminals 16 amp (Raw Material)	4 Nos.	**Common for 2 to 4 semesters**
14	Knife Switch TPDT fitted with fuse terminals 16 amp (Raw Material)	4 Nos.	
15	Voltage Stabiliser Input: 150 – 230 volt AC Output: 220 volt AC	1 No.	
16	3- point D.C. Starter	1 No.	
17	4- point D.C. Starter	1 No.	
18	Electrical Machine Trainer – Suitable for demonstrating the construction and functioning of different types of DC machines and AC machines (single phase and three phase). Should be fitted with friction brake arrangement, dynamo meter, instrument panel and power supply unit	1 for 8 (4+4) Units	**Common for 2 to 4 semesters**
19	Motor-Generator (AC to DC) consisting of : Squirrel Cage Induction Motor with star delta starter and directly coupled to DC shunt generator and switch board mounted with regulator, air breaker, ammeter, voltmeter, knife blade switches and fuses, set complete with case iron and plate, fixing bolts, foundation bolts and flexible coupling. Induction Motor rating: 7 HP, 400V, 50 cycles, 3 phase DC Shunt Generator rating: 5 KW, 440V	1 No.	
20	Used DC Generators-series, shunt and compound type	1 No. each	

	for overhauling practice		
21	D.C. Shunt Generator with control panel,2.5 KW, 220V	1 No.	
22	D.C. Compound Generator with control panel including fitted rheostat, voltmeter, ammeter and breaker, 2.5 KW, 220 V	1 No.	
23	Diesel Generator Set with change over switch, over current breaker and water-cooled with armature, star-delta connections AC 3 phase, 5 KVA, 240 volt	1 No.	**Common for 2 to 4 semesters**
24	DC Series Motor coupled with mechanical load 0.5 to 2 KW, 220 Volts	1 No.	**Common for 2 & 4 semesters**
25	DC Shunt Motor 2 to 2.5 KW, 220 volts	1 No.	
26	DC compound Motor with starter and switch 2 to 2.5 KW ,220 volts	1 No.	
27	Single phase Transformer, core type, air cooled 1 KVA , 240/415 V, 50 Hz	1 No.	
28	Three phase transformer, shell type oil cooled with all mounting 3 KVA , 415/240 V, 50 Hz , (Delta/Star)	1 No.	
29	Oscilloscope Dual Trace, 30 MHZ	1 No.	
30	Function Generator	1 No.	
31	Discrete Component Trainer	1 No.	
32	Linear I.C. Trainer	1 No.	
33	Digital I.C. Trainer	1 No.	
34	Oil Testing Kit	1 No.	**Common for 2 & 4 semesters**
Note: The items which are available in the market nearest of the specification as mentioned above may be procured. Sl no. 18 , Electrical Machine trainer up to 8 (4+4) units- one no. Sl no. 19 to 34 for 4(2+2) units no additional items are required.			

Syllabus for the Trade of "*Electrician*"
Duration : Six Month

Third Semester
Semester Code: ELE: SEM III

Week no.	Trade practical	Trade Theory
1-3	Identification of parts and terminals of AC motors. Connection, starting, running of AC motors using Starters. Measurement of slip, P.F. at various loads. Practice on connection of D.O.L Starter, Star /Delta starter, Autotransformer starter, Rotor resistance starter, etc Speed control of Induction motors by various methods. Practical application of A.C. motors.	**Three phase Induction motor** – Working principle –Production of rotating magnetic field, Squirrel Cage Induction motor, Slip-ring induction motor. Construction , characteristics and Speed control, Slip & Torque . Control & Power circuit of starters D.O.L Starter, Star /Delta starter, Autotransformer starter, Rotor resistance starter, etc Single phasing preventer. Losses & efficiency. Application of Induction Motor Care, Routine & preventive maintenance.
4-5	Connection of single phase motor, identification, testing, running and reversing. Identification, connection, testing, running and reversing of universal motor. Repulsion motor, stepper motor.	**Single phase induction motor-** Working principle, different method of starting and running (capacitor start, permanent capacitor, capacitor start & run, shaded pole technique). FHP motors, Repulsion motor, stepper motor, Hysteresis motor, Reluctance motor. Application of Single phase induction motor **Universal motor**-advantages, Principle, characteristics, applications in domestic and industrial appliances, Fault Location and Rectification. Braking system of motor. Application of Universal motor.
6-7	Identification of parts and terminals of Alternator. Connection, starting, running of Alternator. Practical application of Alternator. Practice on alternators, voltage Building, load characteristic, voltage regulation, Parallel operation. Practice on installation, running and maintenance of Alternators.	**Alternator** Explanation of alternator, types of prime mover, efficiency, regulations, phase sequence, Parallel operation. Specification of alternators and Brushless alternator. Verify the effect of changing the field excitation and Power factor correction of Industrial load.

8	Identification of parts and terminals of Synchronous motor. Connection, starting, running of Synchronous motor. Plot V curve. Practical application of Synchronous motor.	**SYNCHRONOUS MOTOR -** Working principle, effect of change of excitation and load. V and anti V curve. Cause of low power factor. Method of power factor improvement.
9	Starting, running, building up voltage and loading of Motor Generator (MG) set. Maintenance of MG Sets. Solid state controller and Invertors- Operation and Use	Rotary Converter- Inverter, M.G. Set description, Characteristics, specifications-running and Maintenance. Solid state controller and Invertors.
10	Practice on winding of small Transformers.	**TRANSFORMER Winding** , Small Transformer winding techniques
11-12	Testing of burnt DC machine for rewinding – collection of data – developed diagram and connection – winding procedure Making frame(forma), coil insulation, Slot insulation, Insertion of coils in slots, coil connection, Practice on armature winding, Growler testing, Baking, Impregnation and Varnishing & assembling.	**DC machine Winding--** Armature winding terms, pole pitch, coil pitch, back pitch, front pitch , Lap and Wave winding , Progressive and retrogressive Winding, developed diagram. Growler construction, working & application.
13-15	Testing of burnt motor for rewinding – collection of data – developed diagram and connection – winding procedure Making frame(forma), coil insulation, Slot insulation, Insertion of coils in slots, coil connection, Practice on single & double layer, concentric Winding, Winding of table & ceiling fans, single phase and three phase motors – testing of wound motor Baking, impregnating and varnishing & assembling.	**AC machine Winding—** Motor winding terminology – classification of conducting and insulating materials used in winding – Types and methods of winding in single and three phase motors. Stator winding terms, coil side, end coil and grouping of coils. Connection to adjacent poles, connected stator winding, alternate pole connection, developed diagram.

16-17	Installation of - Mercury & Sodium vapours (H.P. & L.P.) Halogen Lamps Single FL tube and twin FL tube. Practice on decoration lighting Principle of layout of lighting installation. Practice on photo cells.	**Illumination**, Laws of Illuminations, terminology used , Illumination factors, intensity of light –importance of light, human eye factor, , units. Types of illumination Type of lamps -Neon sign Halogen, Mercury vapour, sodium vapour, Fluorescent tube, CFL, LED, Solar lamp & photo cell applications, Decoration lighting, Drum Switches, efficiency in lumens per watt, Calculations of lumens. Estimating placement of lights, fans and ratings.
18-19	Practice on wiring of electric motor, control panel, etc. Trace/Test of different circuit Breakers. Protective and control relays, contactors, etc. Operation and use of XLPE cables.	**Industrial wiring**. Code of practice and relevant span. Wiring of electric motors, control panel, etc. Types, specifications, advantages of different types of circuit brackets construction and maintenance. Working principle and construction of domestic and agricultural appliances-their maintenance.
20-21	Practice of wiring Maintenance of institute, hostel, hotel, residential building. Layout and repairing of workshop electrical installation. Fault finding practice	Complete House-wiring layout. Splitting load wire in accordance with NEC I.E.E. Rules. Multi-storeyed system. Fault finding and trouble shooting.
22-23	Industrial visit / project work	
24-25	NCVT EXAMINATION	
26	Semester Gap	

CTS Third Semester: Electrician

SHOP TOOLS, INSTRUMENTS and MACHINERY

Sl. No.	*Name of the items*	*Quantity*	*Remarks*
1	Hygrometer	1 set	
2	a. Cut out Relays b. Reverse current c. Over current d. Under voltage	1 No. each	**Common for 3 & 4 semesters**
3	Starters for 2 to 5 H.P. A.C Motors a. Resistance type starter b. Direct on line Starter c. Star Delta Starter- manual, semi-automatic and automatic d. Auto Transformer type	1 No. each	
4	Motor Generator(DC to AC) set consisting of - Shunt Motor with starting compensator and switch directly coupled to AC generator with exciter and switch board mounted with regulator, breaker, ammeter, voltmeter frequency meter, knife blade switch and fuses etc. Set complete with cast iron bed plate, fixing bolts, foundation bolts and flexible coupling. Shunt Motor rating : 5 HP, 440V AC Generator rating : 3-Phase, 4 wire, 3.5 KVA, 400/230 Volts, 0.8 pf, 50cycles	1 No.	
5	AC Squirrel Cage Motor with star delta starter and triple pole iron clad switch fuse. 2 to 3 HP, 3-phase ,400 volts, 50 cycles	1 No.	
6	AC phase-wound slip ring Motor with starter and switch 5 HP, 400 volts, 3-phase, 50 cycles	1 No.	
7	A.C. Series type Motor with mechanical load ¼ HP, 230V, 50 Hz	1 No.	
8	Single Phase Capacitor Motor with starter switch 1 HP 230 volt 50 cycles	1 No.	
9	Universal Motor with starter/switch 230 volt, 50 cycles ¼ HP	1 No.	
10	Stepper Motor with Digital Controller	1 No.	
11	Shaded Pole Motor	1 No.	
12	Bath Impregnating	1 No.	
13	Oven Stove	1 No.	

Note: The items which are available in the market nearest of the specification as mentioned above may be procured.
Sl no. 3 to 13 for 4(2+2) units no additional items are required.

TOOLS AND EQUIPMENT NEEDED ADDDITIONAL TO EXISTING TOOLS LIST

Sl. No.	*Name of the items*	*Quantity*	*Remarks*
1	Synchronous motor 3 Phase, 3 HP, 415V, 50Hz, 4 Pole, with accessories.	1 no.	
2	Lux meter	1 no.	

Syllabus for the Trade of "*Electrician*"
Duration : Six Months

Fourth Semester
Semester Code: ELE: SEM IV

Week No.	Trade Practical	Trade Theory
1-3	**Machine control cabinet /Control Panel Layout, Assembly & Wiring**: Practice Layout drawing of control cabinet , panel, power & control circuits Preparing control cabinet / panel wiring for 1. Local & Remote control of Induction motor 2. Forward & Reverse operation of Induction motor 3. Automatic Star Delta Starter 4. Automatic star delta starter with change of direction of rotation 5. Sequential control of three motors. **Preparation of Control cabinet & panel**: Necessary marking, cutting, filing, drilling, tapping etc. **Mounting of control elements & wiring Accessories**: Isolator, pushbutton switches, Indicating lamps, meters, MCB, Fuse, Contactor, Relays, Overload Relay, Timers, Rectifier, Limit switches, control transformers, Raceways/cable channel, Terminal connectors etc. **Wiring of control cabinet/panel:** As per wiring diagram. Bunching of wires & cables, channelling, tying etc. Checking / buzzing the wiring. Power connections & motor connection & testing.	**Machine control cabinet /Control Panel Layout, Assembly & Wiring**: Layout of Control cabinet & control panel Study & Understand Layout drawing of control cabinet , panel, power & control circuits. **Control Elements:** Isolator, pushbutton switches, Indicating lamps, MCB, Fuse, Contactor, Relays, Overload Relay, Timers, Rectifier, Limit switches, control transformers. Wiring Accessories: Race ways/ cable channel, DIN Rail, Terminal Connectors, Thimbles, Lugs, Ferrules, cable binding strap & buttons, nylon cable ties, sleeves, Gromats & clips

4-6	Repair & Test of Calling Bell, Buzzer, Alarms, Electric Iron, Heater, Light. Maintenance and repair of domestic equipments – Electric Kettle, Heater / Immersion Heater, Hot Plate, Oven, Geyser, Cooking range, Mixer, Washing machine, , Motor Pump set, etc.	**Domestic Appliances:** Working principles and circuits of common domestic equipment and appliances. – Calling Bell, Buzzer, Alarms, Electric Iron, Heater, Light Electric Kettle, Heater / Immersion Heater, Hot Plate, Oven, Geyser, Cooking range, Mixer, Washing machine, , Motor Pump set, etc. Concept of Neutral and Earth.
7	Practice on Thermal power plant simulator (free version) or Plant visit. To prepare layout plan, single line diagram of the Thermal power system of generation.	**POWER GENERATION :** Generation sources of energy, Comparison of energy resources. Types of fuels. Advantages of liquid fuel & solid fuel. Various ways of electrical power generation. • Thermal • Hydro electric • Nuclear • Non-Conventional Thermal Coal based, diesel based & Gas based Turbine. Constituents in steam power station.
8	Practice on Hydro power plant simulator (free version) or Plant visit. To prepare layout plan, single line diagram of the Hydro electric power system of generation.	**Hydro Electric:** Schematic arrangement of Hydro-Electric Power Station. Constituents of Hydro Electric Plant. Types of Hydro Electric Power station. Advantages & disadvantages.
9	Practice on Nuclear power plant simulator (free version) or Plant visit. To prepare layout plan, single line diagram of the Nuclear power system of generation.	**Nuclear:** Schematic arrangement of Nuclear Power Station. Composition of an atomic Nucleus. Advantages & disadvantages. Comparison of above Power Plant.

10-11	Practice on Non-conventional power plant simulator (free version) or Plant visit. To prepare layout plan, single line diagram of the non-conventional power system of generation.	**Non-Conventional** An introduction to Power generation through non-conventional power generation such as Solar, Bio-Gas, Wind energy and Micro-hydel, Tidal waves, etc. Basic principal, Advantages & disadvantages of each.
12	Identification and specification of different type of insulator used in HT line. Binding of Pin type insulator, shackle type and suspension type insulators. Fixing of jumper by crimping tool.	**TRANSMISSION OF ELECTRICAL POWER** Electrical Supply System : Comparison of AC and DC transmission. Advantages of High transmission voltage. Introduction to Single phase , three phase-3 wire system in transmission lines Overhead Lines: Main components of overhead lines-Types of power line Low voltage line medium Voltage line & high voltage line Voltage standard Conductor materials, line supports, Insulators, types of Insulators
13	Skinning and dressing of cables. Straight joint of different types of underground cables. Test /check the insulation resistance of cables by using megger. Locating the faults (open circuit, short circuit & leakage) in cables.	**Under Ground Cable :** Construction of cables. Material for cables, its insulation. Classification of cables, cables for 3-phase service, Laying of underground cable. Types of cable faults and their location.

14	To visit & prepare layout plan, single line diagram of Transmission /distribution Substation. Installation of bus bar and bus coupler on LT line. Replacement and testing of transformer oil.	**DISTRIBUTION OF POWER** Function and equipment used in substation. Classification of distribution system-AC distribution, Overhead v/s underground distribution system. Essential features of switchgears. Isolator, Switch gear equipments, bus-bar arrangement, Short circuit, faults in power system. **Circuit breakers** – Introduction & Classification of circuit breakers lightening arrestors used in HT lines.
15-16	Speed control of DC motor : Connection, parameterization and speed control by Thyristor/ DC Drive.	Introduction, Construction & Working of power transistor, thyristor. Introduction, Construction, Working, Parameters & application of DC drive.
17-18	Speed control of AC motor : -Uses of SCR and other modern semiconductor devices in controlling speed of motors and in changing the direction of rotation of motors. Connection, parameterization and speed control by AC Drive.	Speed control of 3 phase induction motor by using VVVF/AC Drive. Introduction, Construction, Working, Parameters & application of AC drive
19-21	Break down, Routine & Preventive maintenance of DC/AC machines, Voltage stabilizer, Inverter, U.P.S. & Equipments.	Schedule of electrical preventive maintenance. Break down, Routine & Preventive maintenance of DC/AC machines, Voltage stabilizer, U.P.S. & Equipments.
22-23	Industrial visit / project work	
24-25	NCVT EXAMINATION	
26	Semester Gap	

CTS Fourth Semester: Electrician

SHOP TOOLS, INSTRUMENTS and MACHINERY

Sl. No.	*Name of the items*	*Quantity*	*Remarks*
1	Inverter- 1 KVA with 12 V Battery Input- 12 volt DC, Output- 220 volt AC	1 No.	
2	Domestic Appliances – a. Electric Hot Plate 1500 watt b. Electric Kettle, 1500 watts c. Electric Iron 1500 watts d. Immersion Heater 1500 watt e. A.C. Fan f. Geyser (Storage type) 15 ltr minimum g. Mixture & Grinder	 1 No. 1 No. 1 No. 1 No. 1 No. 1 No. 1 No.	
3	Thyristor /IGBT controlled D.C. motor drive with tacho-generator feedback arrangement 1 HP	1 No.	
4	Thyristor/IGBT controlled A.C. motor drive with VVVF control 3 Phase, 2 HP	1 No.	
Note: The items which are available in the market nearest of the specification as mentioned above may be procured. **Sl no. 1 to 4 for 4(2+2) units no additional items are required.**			

TOOLS AND EQUIPMENT NEEDED ADDDITIONAL TO EXISTING TOOLS LIST

Sl. No.	*Name of the items*	*Quantity*
1	Pentium IV Computer or latest (Server- Linux), 2.8 GHz & above, 1 GB RAM, 80 GB HDD, DVD Combo Drive, 15/17" Monitor, optical scroll mouse, multimedia key board, 32 bit LAN card with UPP port, necessary Drivers, etc.	2 Nos.
2	Ink jet/ laser printer	1 No.
3	Washing Machine	1 No.
4	Motor Pump set 1 HP, 1 Phase, 240 V	1 No.
5	Pin Type, shackle type & suspension type insulators (Raw Material)	2 Nos. each

Syllabus for the trade

of

HEALTH SANITARY INSPECTOR

(SEMESTER PATTERN)

UNDER

CRAFTSMAN TRAINING SCHEME (CTS)

Designed in: 2013

By
Government of India
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
Directorate General of Employment & Training
Ministry of Labour & Employment
EN - 81, SECTOR – V, SALT LAKE CITY
Kolkata – 700 091

List of members of Trade Committee meeting for the trade of Health Sanitary Inspector

SL.No.	Name and Designation. S/SHRI	Representing Organization.	Remarks
01	Shri V.G.Mavani. M.D. & Chairman	Trumax Machine Tools, Rajkot. And Chairman, IMC of ITI Rajkot.	Chairman.
02	Dr.S.J.Rathi, Asst. Professor,	Department of Community Medicine,SBKS Medical Institute & Research Centre, Pipaliya,Di.Vadodara	Member
03	Dr.Niraj Pandit. Associate Professor	Department of Community Medicine, SBKS Medical Institute & Research Centre, Pipaliya,Di.Vadodara.	Member
04	Shri N.K.Bhadradia. Sanitary Inspector	C.U.Shah Medical Colledge,Surendranagar	Member
05	Shri V.H.Rana. Principal	Gujarat Training Centre Vadhavan, Di. Surendranagar.	Member
06	Shri Bhavin N.Rathod. Director,	Gujarat Training Centre Vadhavan, Di. Surendranagar.	Member
07	Shri Pankaj M.Yadav. Consultant	Gujarat Training Centre Vadhavan, Di. Surendranagar.	Member
08	Dr.H.M.Jam. Sr. Medical Officer	S.M.O. Uraban, Vadhavan.	Member
09	Dr.Meera D.Ghoricha. Dental Surgen	Swami Gurukul Hospital, Rajkot.	Member
10	Shri S.S.Lakhani. Health Inspector	C.U.Shah Medical College, Surendranagar	Member
11	Shri M.K.Parmar.	MSW.caritas India,Surendranagar.	Member
12	Shri S.A.Pandav. Regional Deputy Director	Regional Office (Training),Rajkot.	Member
13	Shri P.R.Prajapati Training cum Placement Officer	Regional Office (Training),Rajkot.	Member
14	Shri L.K.Mukheree. Deputy Director	C.S.T.A.R.I., Kolkata.	Member

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Muhkerjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

GENERAL INFORMATION

1. **Name of the Trade** : HEALTH SANITARY INSPECTOR

2. **N.C.O. Code No.** : 3222.10 (Proposed)

3. **Duration** : One Year (2 Semester)

4. **Power** : 4 Kw

5. **Space Norms** : 40 Sq.m.

6. **Entry Qualification** : Passed 10th Class Examination

7. **Unit Size (No. of students)** : 20

8. **(A) Instructor's /Trainer's Qualifications**: Diploma in Sanitary Inspector with 2 years relevant Experience.

   OR

   NTC/NAC in the trade of Health Sanitary Inspector with 3 years experience in the relevant field.

8 (B). **Desirable Qualification** : Preference will be given to Craft Instructor Certificate(CIC)

Note: At least one Instructor must have Diploma in relevant field.

SYLLABUS FOR THE TRADE OF "HEALTH SANITARY INSPECTOR" UNDER CTS.
DURATION - SIX MONTH

First Semester
Semester Code: HSI: SEM I

WEEK NO.	PRACTICAL	THEORY
1-3	**FOOD & NUTRITION** 1. Classification of public health and importance of foodstuffs. 2. Assessment of daily requirement of nutrition. 3. Assessment of nutritional requirement for special group. 4. Coding of balanced diet. 5. Assessment of nutritional Status of family. 6. Survey of Nutrition Education and its importance. 7. Therapeutic Nutrition. **Knowledge of General Safety, Occupational health and hygiene.**	1. Science of food. Introduction to Nutrition, Health & Disease. Classification and of food-stuff Nutrient and their sources (food example) 2. Nutrient: Carbohydrates, Proteins, Vitamins, & Minerals, function, Source and diet requirement of each. Calories-: Supply of calories by proximate principles. Requirement of proximate principle Requirement of vitamins and Minerals. Calorie and protein requirement of infant, weaning, pregnancy, lactation, preschool child, school going child. 3. Family Assessment-: Clinical examination of all members, height and weight for all, head circumference and skin fold for children, blood test for Hb% for all, diet survey, weighing raw food, weighing cooked food. 4. Balanced Diet : Definition, factors to be considered co planning ---- Nutritional requirements of special Groups. Prescription of diet Menu for Hypertensive persons, Nephritis Patients, Diabetic patients, Heart patients 5.Nutrition Education-: Malnutrition Low birth Weight (LBW) Causes of LBW Prevention of LBW Protein energy Prevention of malnutrition Special care to be given to malnutrition Children. Therapeutic Diet- Instruction for balanced diet- weight reduced diet- low fat diet- bland diet- cirrhosis of liver- renal stone. Home management of Malnutrition.

4-6	**WATER SANITATION:** 1. Classification of sources of water. 2. Difference between shallow and deep well. 3. Process of sanitary well. 4. Demonstration of a protected well in village.. 5. Sanitary inspection of water supply. 6. Collection and despatch of water sample for chemical arsenic and bacteriological examination. 7. Purification of water in urban area. 8. Purification of water in rural area.	**1.WATER :** WHO's definition of environmental Sanitation. Safe and whole some water, Sources of water, Various uses of water and its need. Water borne diseases, conservation source of water, quality of water, public health aspect of very hard water, Steps of disinfection of well. Physical, chemical and biological standard for portable water sources and nature of pollution of water in large scale and small scale. Process of disinfections of water in large and small scale provisions for sanitary wells and tube wells, plumbing system and its maintenance. Water supply and storage system at the community and domestic level.
7	**AIR SANITATION:** 1. Demonstration of an air-conditioning plant for thermal comfort. **NOISE**	**2. AIR** Concepts and importance of adequate ventilation. Types of ventilation. Natural ventilation.
8	Measures and reduce of intensity of air pollution. **REFUSE DISPOSAL :**	Mechanical ventilation. Indicators of air pollution. Process air purification and disinfection. Green house effect, types of ventilation, thermal comfort, air
9	1. Method of waste disposal. 2. Demonstration and operation of compost pits , sanitary land filling and insanitation process.	temperature humidity, radiation, evaporation and their measurements.
10-11	**NIGHT SOIL DISPOSAL :** 1. Construction and maintenance of sanitary latrines. - soakage pit. - sanitary latrine. - RCA latrine - Septic tank latrine - Sewage treatment plant. - Sulabh Sauchalaya 2. Maintenance of trenching ground	**3. SOLID WASTE DISPOSAL** Source of generation, storage and collection. Sanitary method of disposal of solid waste. Classification of solid waste in the community. Polluting affect of different types of solid waste, system of collection of solid waste from the houses and street, sanitary transportation of solid waste, sanitary process of disposal of solid waste such as composting, sanitary land filling, incineration.

12-13	**SEWAGE DISPOSAL :** 1. Demonstration of sewage treatment plant. 2. Inspection of flushing tank, soil plant, traps, man holes, inspection chambers and maintenance of gully trap. 3. Collection of sewage sample for chemical and bacteriological analysis and interpretation or reports. 4. Inspection and maintenance of sewage treatment plants and disinfections of stabilized sewage. 5. Organization of cleaning, minor engineering and oil operation of the sewage system. 6. Detection of pollution of water from sewage.	**4. LIQUID WASTE DISPOSAL** Hygienic method of disposal of liquid waste. Health hazard related to accumulation of liquid waste or in sanitary drainage system. Construction and maintenance of sanitary sewerage system .Use of different types of traps, pollution of water sources from sewerage and its disinfection **5. NIGHT SOIL DISPOSAL** Sewage is liquid waste containing human excreta. Fly nuisance Soil pollution. Water pollution Food contamination, Faucal - borne disease due to unsanitary disposal. Different types of latrines in use principal of construction of sanitary latrines and their use, especially berg hole, dug well, RCA and septic tank latrine. Sewage system or water carriage system. What is sewage.Why sewage purification is required. Sewer appurtenances, house drain. Street sewers or municipal sewers. Sewage forming land treatment. Sewage disposal by Biogas plant or gobar gas plant. Methods of disinfection of sewage. Sanitary practices of sewage farming
14	**BURIAL OF FUNERAL GROND** Visit to burial or funeral ground for sanitation , proper process of disposal of dead body and maintenance of records as per legal provision .	**6 . BURIAL AND CREMATION GROUND AND MASS CAUALTY DISPOSAL** :- Disposal of dead- Human. Burning or cremation. Requirement for a burning ground. Disposal of dead bodies and maintenance of their records.

15 - 16	**SOIL SANITATION** 1. Sampling for assessment of soil pollution . 2. Treatment of soil to alter the PH and disinfections.	**7 . SOIL SANITATION :-** Classification of soil. Classification from the view point of importance in Public Health. Reason for the excessive moisture in the soil. Reclamation of land. Soil, bacteria and parasites. Soil and Health. Study on insecticides, pesticides and disinfections. Sterilization & disinfection of different Articles. Various spraying equipments.
17-18	**CONTROL OF BIOLOGICAL ENVIRONMENT :-** 1. Identification and use of insecticides, pesticides and disinfection 2. Application of Techniques of sterilization and disinfection of various articles. 3. Identification of different parts of spraying equipments 4. Operation and maintenance of spraying equipment . 5. Use of Larvicide's. 6. Use of rodenticides	Study on insecticides, pesticides and disinfections. Sterilisation & disinfections of different articles. Various spraying equipments. Uses of rodenticides & larvaecidals.
19	**HOUSING** Survey of housing for assessing sanitary standards and prescription of re medical measures.	**8 . HOUSING :-** General principal of healthy housing. Home Sanitation. Food hygiene at home. Specification for healthy housing.
20-21	**FAIRS AND FESTIVALS** Inspection and preparation of fair and festival, industry and trade.	9. **SANITATION MEASURES IN FAIRS, FESTIVALS AND NATURALCALAMITIES-MASS CASUALTY DISPOSAL :** Sanitation Management at fairs and festival. Sanitary problems associated with human gatherings and temporary settlements. Alternate emergency sanitary provisions to prevent sanitation crisis for food, housing, water supply, lighting, disposal of community waste and prevention of outbreak of epidemics.

22-24	**OCCUPATIONAL HEALTH** 1. Inspection of trade premises. 2. Visit to a factory for survey of sanitation problems of the workplace. 3. Identification of danger zones and adequacy of safety arrangements. 4. Health and sanitation survey of the vicinity of the industrial establishment for identification of health problems emerging from industrial pollution and suggestions for remedial measures. Environmental pollution- its causes, consequences, mitigation and remedies.	**OCCUPATIONAL HEALTH** Industrial hygiene- workers health protection- occupational risk factors and safety measures- control of dust and other hazardous substance- safety measure for occupational risk factor- legislative provisions- benefits to employees ***Incorporation of Municipal Rules and Regulation in Sanitation***.
25	**Project work / Industrial visit (optional)**	
26	**Examination**	

SYLLABUS FOR THE TRADE OF "HEALTH SANITARY INSPECTOR" UNDER CTS.
DURATION - SIX MONTH

Second Semester
Semester Code: HSI: SEM II

WEEK NO.	PRACTICAL	THEORY
01	1. Prepare a report on general survey of health care in different area.	**1. <u>COMMUNICABLE DISEASES</u>:** Introduction, Disease transmitted through air-Diseases transmitted by air- Diseases transmitted by contact- Diseases transmitted by insects and other diseases. General measures for prevention & control of communicable diseases. *Role of Health Worker*
02	2. Organizing immunization services.	**2. <u>IMMUNITY & IMMUNISATION</u>:** Purpose, types & effects. National immunization schedule for prevention of major communicable diseases – BCG, DTP, polio. Measles & Typhoid Vaccines.
03	3. Ensuring disinfection of hospital wards, Operation Theatre, Labour Room.	**3. <u>DISINFECTION&STERILISATION</u>** Effective disinfection by liquid Chemical agents like Halogen, Potassium per magnate solution etc. Solid chemical agent-Bleaching – Bleaching powder, Lime etc.
	4. . Participation in various programmes.	**4. <u>NON –COMMUNICABLE DIESEASES:</u>** Introduction- Incidence and prevalence: Diagnosis & prevention.
04	5. Conducting programmers on personal hygiene in different area.	**5. <u>PERSONAL HYGIENE:</u>** Factors influencing health &hygiene. Health hobbits & practice. Maintenance of normal circulation ,respiration digestion etc. Skin care cleanliness. Dental care. Care of hands, washing, Exercises importance. food values. Nutrition.
05	6. Arranging First aid treatment in case of emergency.	**6. <u>FIRST AID:</u>** Treatment of common ailments.

WEEK NO.	PRACTICAL	THEORY
06 - 07	**HEALTH STATISTICS** Health information and basic statistics, Exercises related to sampling procedure, demography, mean, media and mode, standard deviation, computation of rates and ratio (regarding) fertility , morbidity and mortality), tabulation of data, analysis of data ,preparation of groups, charts and maps and interpretation.	**HEALTH STATISTICS** To enable the student to have understanding of the terms like statistics and Bio- statistics and their applications and relation to public health.- rates and ratio- averages: mean, medium and mode- deflation of common rates- Various types of presenting data. Presentation of data, Necessity of sampling, Types of sampling methods, Analysis of data. Interpretation of data. Morality statistics, Morbidity statistics, Tabulation of Data Histogram, Ogive, pie Chart, Bar chart.
08 - 10	**PUBLIC HEALTH ACTS** Collection and dispatch of food samples for analysis and preparation of papers for legal proceeding. performance of simple household tests to identify adulteration in Milk, ghee, oil, sugar, tea, etc. Acquaintance with the registration, reporting and documentation process for implementation of different acts.	**DEMOGRAPHY AND HEALTH SURVEY** a) Registration of birth, death and mortality b) immunization process **PUBLIC HEALTH ACTS** :- Indian Epidemic Diseases Act. Purification of Air And Water Pollution Acts. Prevention of Food adulteration Act. Birth and Death Registration Act. N.T.P ACT. Suppression of immoral Traffic Act (SITA). Municipal and local body Acts related to housing, sanitation etc. Factory Act and Employer's State Insurance Act.

11 - 13	**PUBLIC HEALTH ADMISTRATION** Visit to different types of health organization and acquaintance with their system (sub –center) PHC, hospitals, municipality). Evolution of health services. Study and maintenance of record and repots related to public health practices in different organization	**PUBLIC HEALTH ADMINISTRATION** Organization of National Health Care Services. System of National Health Care Services Sub Center – c) Primary Health Care d) Community Health Care e) Specialization Health Intuitions. Health services in India before independence Health services in India after independence Current status of India.
14 - 17	**PRIMARY CARE (First Contact)** Dressing of wounds, bandaging- Management of bone injuries with splints, slings. Transportation of injured and unconscious case and their managements. Diagnosis and treatment of minor alignments – diarrhea disorders, gastric problems, pain, cough, fever, skin condition, conjunctivitis, care of bleeding, toothache. Management of poisoning. Artificial respiration.	Central, State and Local organizations in India. Relation with other departments International organizations and their cooperation in the field of Health. (WHO, UNICEF, UNDP(United Nation Development Programme) Voluntary Agencies in Health Programmes Operation Aspects of National Health Programs- f) Family Welfare Program g) Maternity & h) child Health Service i) National Malaria Eradication program. j) National Filarial Control program k) National Leprosy program l) Diarrheas Disease Control program m) STD Control program n) Goiter Control program o) Blindness Control program p) Universal Immunization program

18 - 19	**PERSONAL HYGIENE** Brief Study of the body connected with personal hygiene. Inspect school and catering establishments for assessment of personal cleanliness and hygienic practices and ensuring maintenance of desirable standard	**BEHAVIOURAL SCIENCE** Habit and customs affecting personal Hygiene. Care of the body-habits clothing. Menstrual hygiene. Care of special sensory organs. Oral hygiene. Factors influencing human behavior. Change of behavioral pattern in different age groups. Interpersonal relations and defense mechanism.
20 - 24	**HEALTH EDUCATION AND COMMUNICATION** Practical exercises for designing messages, preparation of audio-visual materials, use of audio-visual aids. Identification of homogenous group , for imparting group health education. Identification of contact person. Leadership for gaining access to the community. Assessment of both desirable and organize health education program to bring about desirable changes . Make personal contact to motivate for the acceptance of health program or healthful practices.	**HEALT H EDUCATION** Health Education opportunities for Health Inspector in his work place.. Use of audio visual aids and media. Health Education approach.. Content of Health Education Principal of Health Education Planning Health Education activities. Education in relation to environmental sanitation programme. Health Education material on environmental sanitation. Education on personal hygiene. Utilizing Community Resources for Health Education. Education through primary Health centre Health Education through personal contract, group meetings and indirect approaches. AIDS perception.
25	**Revision**	
26	**Examination**	

TRADE: HEALTH SANITARY INSPECTOR

LIST OF TOOLS & EQUIPMENT

SL NO	Name of the item	Qty.
	A. **AUDIO-VISUAL AIDS.**	
1	Overhead Projector.	1 no
2	LCD Projector	1 no
3	Personnel Computer with multimedia facilities	1 no
	B. **Working Models For**	
1	Ventilation.	1 no
2	Sewage system and Treatment plan	1 no
3	Water purification plant	1 no
4	Sanitary plant	1 no
5	Waste disposal plant.	1 no
	C. **General outfits**	
1	Refrigerator.	1 no
2	Autoclave	1 no
3	Sterilizer.	1 no
4	Fluoroscope	1 no
5	Thermometer	1 no
6	BP Instrument	1 no
7	Stethoscope	1 no
8	Hemoglobin meter	1 no
9	Laboratory Microscope	1 no
10	First Aid Kit.	1 no
11	Needles and Syringes	As per requirement.

NOTE:-

Six weeks on the job training can be arranged with local agency (Municipality, Zila Parishad, Metropolitan development Authority, Secondary Hospital etc.) to expose the trainees with water treatment plant, sanitation, waste disposable plant, vaccination etc.

HEALTH EDUCATION CHARTS

Standard charts related to Health and Sanitation – Assorted.

Books/Manuals on Air and Water Pollution Acts, Epidemic diseases Act, Public and Health Acts and Municipal Acts, Factory Acts and State Insurance Act.

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Syllabus for the trade of

PHYSIOTHERAPY TECHNICIAN

(SEMESTER PATTERN)

under

CRAFTSMAN TRAINING SCHEME(CTS)

Designed in: 2013

By

Government of India CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE Directorate General of Employment & Training Ministry of Labour & Employment EN-81, SECTOR-V, SALT LAKE CITY KOLKATA-700091

LIST OF MEMBERS ATTENDED TRADE COMMITTEE MEETING

Sl.No.	Name & Designation	Office	Remarks
1	Sri M.S. Lingaiah, Director	CSTARI, Salt Lake, Kolkata - 91	Chairman
2	Prof. S. Basu, Special Secretary Health and Family Welfare.	Govt. of West Bengal, Deptt. Of Health.	Member
3	Prof. S. Pal, Professor, Biomedical Engg.	Jadavpur University, Kolkata-72	Member
4	Sri Aminul Ahsan,	West Bengal Voluntary Health Association	Member
5	Sri Jnan Praakash Poddar	Indian Institute of Training & Dev. SRIJAN, Kolkata.	Member
6	Dr. Jyanta Kr. Paul	Nilratan Sarkar Medical College Hospital, Kolkata.	Member
7	Dr. Prabir Chowdhury, Radiation Oncologist.	Chittaranjan National Cancer Institute	Member
8	Dr. Soumitra Kr. Chowdhuri, Head,	Chittaranjan National Cancer Institute	Member
9	Dr. Suparna Majumdar, HOD/Deptt. Deptt. Of Radiology.	Chittaranjan National Cancer Institute	Member
10	Dr. P.K.Sarkar, Head, Health Physics Unit.	Variable Energy Cyclotron Centre.	Member
11	Prof. Anjali Mukherjee, Sivatosh Mukherjee Science Centre	S .M. Sc., Kolkata - 25	Member
12	Dr. R. Kumar Angrish	Life Aids Physiotherapy Unit, New Alipore, Kolkata.	Member
13	Mrs. Prachi Angrish	- do -	Member
14	Sri R. Senthil Kumar, JDT	CSTARI, Salt Lake, Kolkata-91	Member
15	Sri M.M. Gera, DDT	CSTARI, Salt Lake, Kolkata-91	Member
16	Sri T. Mukhopadhyay, DDT.	CSTARI, Salt Lake, Kolkata-91	Member
17	Sri S. Kumar, JDT	CSTARI, Salt Lake, Kolkata-91	Member
18	A.Chakraborty, ADT	CSTARI, Salt Lake, Kolkata-91	Member
19	Sri P.K. Koley, T.O.	CSTARI, Salt Lake, Kolkata-91	Member
20	Mrs. Anindita Chakraborty, Psychologist.	Salt Lake, Kolkata	Special Contributors
21	Dr. N.L. Dutta Banik	Kolkata.	Special Contributors
22	Dr. K.L. Ganguli	Bharat Seva Shram Sangha	Special Contributors

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Muhkerjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

GENERAL INFORMATION

1. Name of the Trade — Physiotherapy Technician

2. NCO Code No

3. Duration : One year (Two semesters)

4. Power Norms : 3 Kw. : 100 sq. Mtrs

5. Space Norms

6. Entry Qualification : 10^{th} class passed

7. Unit Size (No. of students) : 16

8. Instructor's/Trainer's Qualification:

(a) Degree or Diploma in physiotherapy with 1 or 2 years post qualification experience respectively.

Or, NTC/NAC in the relevant trade with 3 years post qualification experience.

(b) Desirable Qualification: Preference will be given to a candidate with Craft Instructor Certificate..

***Note:** **At least one Instructor must have Degree or Diploma in relevant field.**

SYLLABUS FOR THE TRADE OF PHYSIOTHERAPY TECHNICIAN

Under Craftsman Training Scheme (CTS)

Duration : Six Month

First Semester

(Semester Code no. PHT - 01)

Week No.	Trade Practical	Trade Theory	Engineering Drawing	Workshop Cal. & Science
1.	Demonstration & A.V. display	**i) Introduction_to Anatomy/Physiology** a) Definition & the sub-divisions of anatomy. b) Anatomical & fundamental position. c) Anatomical regions, sections & planes. The descriptive Anatomical terms	Basic concept of Engineering Drawing , 1st & 3rd angle projection .	Force-definition, diagrammatic representation. Classification of forces. Concurrent, coplanar and co-linear forces. Composition and resolution of forces, angle of pulls of muscle.
2.	1. Techniques of Massage of different parts of the Human Body- 2. Kynationology 3. Head & Neck Massage b) Arms Massage c) Back Massage d) Upper leg, Lower leg & Foot Massage 4. Therapeutic application of Massage (such as Bell's palsy, Paraplegia, Hemiplegia etc.)	**ii) Osteology** a) Basic terminologies b) About the skeleton c) Brief descriptions about Bone & Cartilage (structure, types , functions etc.) d) Identification, side determinations & structural details of bones of skull, Thorax, Vertebral column, Upper & Lower extremities	-do-	-do-
3.	Demonstration & A.V. display	**iii) Orthrology** a) Definition & classifications of joints b) The terms related to the movements of joints c) Description of joints of the upper & lower extremities with their ligamental	Basic free hand sketches of various geometrical shapes.	Calculations of percentages. Ratio and proportion, Inverse-square law. Geometry of triangles.
4.	Demonstration & A.V. display	**iv) Neurology** a) Knowledge of CNS and its pathology. b) Knowledge of Central Nervous System & its pathology. c) Description about Spinal nerves d) Nerve plexus of the body with their distributions (cervical plexus, brachial plexus, limbo-sacral plexus) **v) Myology**	-do-	Momentum, its principles and practical applications.

		a) Classifications & structures of Muscles b) Description of all major muscles with their origin, insertion, nerve supplies, blood supplies & actions. c) Muscles acting on joints of upper & lower extremities		
5.	Demonstration & A.V. Display Study of different X-Ray plates	**vi) Visceral Anatomy** Description of organs related to Digestive, Respiratory, Circulatory, Excretory & Reproductive System (in brief) **vii) Radiological Anatomy** Demonstration of some normal and abnormal x-ray plates.	Types of lines and its applications, line practice.	Laws of Friction and its applications.
6-7	Identification of bones, nerve routes and mussel attachment, related surface, reading X-ray plates, types of joints & their movements in different axes, Nerve muscle physiology, measurement of B.P. pulse & idea of reflexes and their examination	viii) **Applied Anatomy** Common clinical conditions of Axial & Appendicular skeleton such as, a) Carpal tunnel syndrome b) Erb's palsy c) Klumpke palsy d) De Quervain's disease **e)** Dupuytren contracture g) Trigger finger, Mallet finger h) Wrist ganglion i) Rotator cuff Impingmentation Syndrome (R.C.I.S) j) Fixed Flexion Deformity (F.F.D) k) Wrist drop l) Road Traffic Accident (R.T.A) m) Deltoid ligament rupture n) Achilles tendon rupture o) Trendelenbrug's sign p) Tarsal tunnel syndrome q) Genus vulga/vera r) Coax vulga/vera s) Hallux valgus t) Foot drop	Types of lines and its applications, line practice. Lettering practice.	Electric current, voltage and resistance. Ohm's law and its applications. Introduction to AC and DC circuits. Measurement of current and voltage.
8.	Nerve muscle physiology, measurement of B.P.Pulse and idea of reflexes and their examination Case history recording & follow-up in Clinic on patient.	**PHYSIOLOGY** i) Cell- definition, structure & function - Tissues - structure, function. ii) circulatory system **a)** Structure & function of heart b) Heart rates & Heart sound c) Blood circulation d) Composition & function of Blood e) Blood pressure & the influencing factors iii) Nervous system **a)** About the Nervous tissue- Neuron (structure & function), Neuroglia (Definition) b) About the Nerve fibers- motor & sensory	Reading of different types of scales and its applications.	Gravity: definition, line of gravity, centre of gravity.

		c) Divisions of Nervous system d) Central Nervous System-classifications, structures & functions of Brain & Spinal cord (in brief) e) Peripheral Nervous system-Cranial Nerves (names & functions) & Spinal Nerves (introduction) f) Sensory System-pain **iv) Skin & Temperature regulation-** a) Structure of skin b) Function of skin c) Temperature regulation system		
9.	-do-	**v) Food & Nutrition-** a) Definition & types of Food (carbohydrate, protein, fat, minerals,. Vitamins, water with example & brief descriptions b) Balance diet c) Relation between Food & Nutrition **vi) Digestive System-** a) Structure & function b) Details of food materials c) Steps of Digestion , Absorption & metabolism (in brief) c) Neurological factors related to Digestion	-do-	-do-
10.	-do-	**vii) Respiratory system-** a) Structure & Function b) Process of Respiration b) Technical datas related to pulmonary activity in relation to stress & rest c) Cardio-Respiratory relation d) Artificial Respiration e) Neurological control **viii) Endocrinology-** a) Definition, character & function of Hormones b) About the Hormone secreting glands c) Hormonal control on physiological activities **ix) Excretory system-** a) About the nephron b) Structure & function of Kidney c) Formation of urine d) Micturation	Free hand sketches of different types of tools used related to the trade.	Equilibrium: supporting base, types and stability of equilibrium.
11.	Antenatal and postnatal exercises.	**GYNAECOLOGY & OBSTETRICS** 1. Introduction to Human Reproductive System 2. Physiology of pregnancy	-do-	Work, power, energy: types of energy.

12.	Identification of different Tools , equipment	***PHYSIOTHERAPY*** **i. Introduction:** a) definition of Physiotherapy Terms of Physiotherapy i.e. Electrotherapy, Exercise-therapy, Massage-therapy, Ergonomics, Rehabilitation. d) definition of electrotherapy, Safety precautions in Electrotherapy. e) Physical modalities, which are used in Physiotherapy.	Study of the drawing related to various bones of human.	Levers: definition, function, classification and application of levers in physiotherapy and order of levers with example of lever in human body
13.	Application of ice pack, cold pack, ice towels, ice bath, ice cube message.	2. **Cryo therapy :** a) Physiological effects b) Methods of application (ice pack, cold pack, ice towels, ice bath, ice cube massage, vapocoolant sprays) c) cryokinetics d) Indications & Contraindications	-do-	-do-
14.	Demonstration of hot packs, Kenny packs, hot water bag etc. & its applications.	**3.Thermotherapy: a) Superficial Heating Agents-** A. Hot packs- Physiological effects, types of Hot Packs (hydrocollators, Kenny packs, hot water bag, electrical heating pads) with their Techniques of application, Indications & Contraindications	-do-	-do-
15.	Demonstration and Practice on wax bath preparation & its applications.	**B. Wax bath -** About the wax, Descriptions of a Wax bath Unit, Composition & method of preparation of wax bath, physiological effects, Techniques of application, Indications & Contraindications.	Free hand sketches of bones, spinal cord and joints.	Pulleys: system of pulleys, types and applications.
16.	Demonstration and Practice on infra-red applications.	**C. Infra-Red Radiation-** About the Infra-red rays, Sources of Infra-red rays, Technical datas, Physiological effects, Techniques of application, Terminations of IRR, Indications & Contraindications.	-do-	-do-
17.	Demonstration on application on S.W.D.	**b) Deep Heating Agents -A) S.W.D-** meanings of Short-wave & Diathermy, Effects of S.W.D. Technical datas, Descriptions of a S.W.D Instrument, Method of application, Positioning of Electrode pads During, Treatment, Dose & Duration of treatment, Indications & Contraindications.	-do-	Specific gravity, hydrostatic pressure, Archimedes principle. Properties of water and other liquids.
18.	Demonstration and Practice	**B) M.W.D-** Introduction. **C) U.S.T-** About the Ultra sound, Difference among Ultra sound, Infra sound & Audible sound, Effects of U.S.T in Human body, Technical datas, Descriptions of an U.S.T	-do-	-do-

		Instrument, Description about different types of Coupling medium, Method of application of U.S.T, Dose & Duration of treatment, Indications & Contraindications.		
19-21	Demonstration. Demonstration on Applications of TENS	**Stimulators-** **a) Faradic** - About the Faradic type of current, Technical datas,. Description of a Faradic Stimulator & Electrodes, Physiological effects, Method of application (Motor point stimulation method, Nerve conduction, method, Unipolar & Bipolar Faradic Bath method etc.), Application of continuous & Surged Faradic, Dose & Duration of treatment, Indications & Contraindications. b) **Galvanic-** About the Galvanic type of current, Technical datas, Descriptions of a Galvanic Stimulator, Physiological effects, Method of application (Sensory point or Determinations stimulation method, ath method etc.), application of continuous & Interrupted Galvanic, Dose & duration of treatment, Indications & Contraindications. **c) T.E.N.S-** Meanings of 'transcutaneous', difference between transcutaneouis & percutaneous, Technical datas, Description of a T.E.N.S., Physiological effects (among with pain gate Theory), Method of application (Trigger point stimulation method, Acupuncture point stimulation method etc.), Placements of T.E.N.S electrodes, Application of continuous, surged & brust mode. Dose & Duration of treatment, Indications & contraindications. d) **I.F.T-** Introduction, application, Indications & Contraindications.	-do-	Buoyancy law of flotation. Factors determining up-thrust, effect of buoyancy on movements. Equilibrium of floating body. Bernoulli's theorem.
22. to 24.	Demonstration on application on U.S.T.etc. Demonstration on basic massage techniques, gait training.	**Clinical Decision Making in Electrotherapy-** Differential application of S.W.D, U.S.T, F.S, G.S, T.E.N.S, I.F.T, I.R.R, Wax bath. **MASSAGE THERAPY & REHABILITATION.** a) Definition of Massage b) Aim of Massage c) Physiological effects of Massage d) Therapeutic uses of Massage	-do-	-do-

		e) Contraindications of Massage f) Materials used in Massage (oil, powder, ice etc.) g) Rules & direction of Massage h) Types of Massage		
25.	**(i) Project Work(ii) Industrial Visit (Optional)**			
26.	**Examination**			

SYLLABUS FOR THE TRADE OF PHYSIOTHERAPY TECHNICIAN

Under Craftsman Training Scheme (CTS)

Duration : Six Month

Second Semester (Semester Code no. PHT - 02)

Week No.	Trade Practical	Trade Theory	Engineering Drawing	Workshop Cal. & Science
1.to 7.	Application of traction, uses of walking aids	**EXERCISE THERAPY & YOGA.** **a. Exercise Physiology:** 1. Energy System -_a) Metabolism b) Energy in Muscular Activity- ATP-PC System, Lactic Acid System, Oxygen System c) Aerobic & Anaerobic pathways during Rest & Exercise d) Measuring energy during Exercise 2. Foods, Nutrition & Exercise Effects of Exercise on Carbohydrate, Protein & Fat Requirement 3. Thermoregulation & Exercise organs. a) Conduction, Convection & Evaporation b) Regulation of Internal Body Temperature c) Physiological thermoregulation d) Heat Disorders- Heart Stroke, Heat Exhaustion, Heat Cramp. 4. Respiration- a) Muscles for Inspiration & Expiration b) Static & Dynamic Lung Volume c) Gaseous Exchange d) Adaptational changes to physical training e) Maximum aerobic Capacity VO2 Max.) 5. Cardiovascular Adaptations-a) Sub maximal Exercises b) at maximal Exercises 6. Fatigue - a) Types of b) Symptoms c) Methods of Recovery 7. Exhaustion 8. Endurance- a) Definition b) Endurance Training 9. Kinesiology &	Free hand drawing of skeleton of human body Drawing of human body & different organs.	Elasticity: definition, stress, strain, Hooke's law. Springs: properties of springs, spring in series and parallel, elastic materials in use.

		Biomechanics: Basic terminologies & practical approach		
8. to 13.	Demonstration.	**B. Fundamentals of Exercise** 1. Definition of Exercise 2. Benefits of Exercise 3. Physiological changes during Exercise. 4. Classifications of Exercise- active, passive, resistive, isometric, functional, stretching, strengthening, closed-chain, open-chain etc. **C. Applied Exercise Therapy** 1. Manual Muscle Testing 2. Techniques of Stretching Exercise- Region of shoulder, elbow, wrist, trunk, hip, knee, ankle 3. Exercises for Muscles Strengthening - Region of shoulder, elbow, wrist, trunk, hip, knee , ankle 4. Techniques of P..F. 5. Techniques of Breathing Exercises. 6. Exercises for Co-ordination & Balance 7. Exercise with Instruments 8. Exercise for increase ROM 10. Goniometry 11. Exercise as a Treatment of Diseases a) Cervical Spondylosis b) Lumber Spondylosis c) Ankylosing Spondylosis d) Tennis Elbow e) Golfers Elbow f) Joint Stiffness g) Frozen Shoulder h) Bell's palsy I) Paralysis j) out k) R.A l) O.A. m) Foot Drop n) Wrist Drop o) Perkinsonism	Drawing of major muscles , nerve supplies & blood supply & action. Drawing of different joints of human organ. Drawing of Digestive, Respiratory & Excretory system	Definition of radiation and its types. Electromagnetic (EM) radiation. Radiation as a wave motion. Wave length, frequency, amplitude, velocity and their relation. Concept of Quanta. Energy of radiation . Electro magnetic spectrum , common properties of radiation
14. to 19.	Demonstration.	**ORTHO-NEURO-GENERAL** **Orthopaedical condition:** Etiology, C/F, Investigations & Physiotherapeutic Management of the followings: -i) Kyphosis ii) Lordosis iii) Scoliosis iv) Cervical Spondylosis v) Lumber Spondylosis vi) Ankylosing Spondylosis vii) Tennis Elbow viii) Folger's Elbow ix) Gout	Different drawing of bones, nerve roots & muscle attachment. Sketches of heart Sketches of Neurons and nerves.	**Bio chemistry:** Chemistry of water, Mineral, Vitamins, Protein, Carbohydrate, Lipids, Nucleic acids, Enzymes, Blood, Extra cellular fluids.

		x) Osteo-arthritis xi) Rheumatoid Arthritis xii) Frozen Shoulder xiii) Fracture xiv) Dislocation & subluxation xv) Sprain xvi) Tendonitis. xvii) Rickets xviii) Osteomalacia xix) Osteomyelitis xx) Calcaeneal Spar xxi) Flat foot. **Neurological Condition:** Etiology, C/F, Investigations & Physiotherapeutic Management of the followings:- i) Cerebral palsy ii) Hemiplegia iii) Paraplegia iv) Quadriplegia v) Myalgia vi) Fibromysities vii) Polio Myelitis viii) Parkinsonism ix) Bell's palsy x) C.V.A xi) Upper & Lower Motor Neurone diseases xii) Peripheral Nerve Injury xiii) Spinal Cord Injury xiv) Sciatica **General condition:** Etiology, C/F, Investigations & Physiotherapeutic Management of the followings: - i) Obesity ii) Burns iii) Epilepsy etc.	Sketches of digestive system Sketches of respiratory system Sketches of excretory system	Metabolism of Carbohydrate, Proteins, Lipids, Amino acids, Hemins, Purimes, Pyrimidies and Nucleic Acids. Nature, properties, Kinetics and mechanism of action of energy and co-enzymes, Biological oxidation and bio-energetic. Basic Ideas of Chemical Reactions
20. to 24.	**CASE STUDIES**			
25.	**Revision**			
26.	**Examination**			

LIST OF TOOLS AND EQUIPMENT

For Physiotherapy Technician

For a batch of 16 trainees.

Sl. No.	Items	Quantity.
1	Diagram of -(i) Human Organs "l Exercises charts J	1 set
2	Wax bath	1 no.
3	I. R. Radiator	1 no.
4	Short wave Diathermy unit	1 no..
5	Electric Muscle nerve Stimulator	1 no.
6	Battery 6 V & 12V	2 nos.
7	Battery Eliminator 6V, 9V, 12V	2 nos.
8	Traction set up including Pulley, Weight Table unit	1 set.
9	Apparatus for various exercises-Shoulder Wheel, Shoulder pulley, Finger exerciser.	1 Set Assorted
10	Durra mats	10 nos.
11	Table	1 no.
12	Chair with Desk	16 nos.
13	Cup Board	2 nos.
14	IFT (Interferential Therapy)	1no.
15	TENS (Trans Electric Nerve Stimulator)	1 no.
16	Ultra sound Apparatus	1 no.

SYLLABUS OF SEMESTER SYSTEM
FOR THE TRADE OF

WELDER (PIPE)

SEMESTER-I & II

Under

Craftsmen Training Scheme (CTS)
(One year / Two Semesters)

Redesigned in
2014

By
Government of India
Ministry of Labour & Employment (DGE&T)

GENERAL INFORMATION

1. Name of the Trade : **WELDER (PIPE)**

2. N.C.O. Code No. : **7212.10, 7212.20, 7212.40 & 7212.50**

3. Duration of Craftsmen Training : 12 months (2 Semesters)

4. Power norms : 16 KW

5. Space norms : Workshop: 80 Square meters. (5 Sq.m/trainee)

6. Entry Qualification : Pass 8th Class Examination.

7. Unit size (No. of student) : 16

8. Instructor's /Trainer's qualification Trade theory & trade practical

(A) : Essential (any one of the below)

(i) NTC/NAC with Three years Experience in relevant field with Craft Instructors Training

Certificate.

(ii) Diploma in Mechanical and allied with two years experience in relevant field.

(iii) Degree in Mechanical / Metallurgy / Production Engineering/Mechatronics with one Year experience in relevant field.

(B) Desirable qualification: for (ii) & (iii) Craft Instructors Training Certificate.

Note:

(i) Out of two Instructors required for the unit of 1+1, one must have Degree/Diploma and other must have NTC/NAC qualifications.

(ii) Instructor qualification for W/shop Calculation, Engg Drawing & Employability Skill would be as per the training manual.

COURSE INFORMATION

Introduction

- This course is meant for the candidates who aspire to become a professional welder specializing in all position welding on pipe & tubes. To meet the demand for fuel and power, exploration, refining and transportation of the medium in gas and liquid form plays an important role. In these industries expertise in all position welding is very much essential.
- This course is renamed & restructured as WELDER(PIPE) from the existing COE Fabrication sector as follows.
    - First year BBBT - Basic welding (2months) module is converted in to CTS first semester WELDER (PIPE) course.
    - Second year advanced module PRESSURE VESSEL & PIPE WELDING is converted in to CTS Second semester WELDER (PIPE) course.

Terminal Competencies/Deliverables:

After successful completion of this course the trainee shall be able to perform the following skills with proper sequence.

1. Welding of M.S. Sheet and M.S. Pipe by GAS welding process.
2. Welding of M.S. Plate in all position by SMAW process.
3. Straight, Bevel & Circular cutting on MS. Plate by Oxy-Acetylene cutting process.
4. Repair & Maintenance works
5. Gouging, Gas and Plasma cutting on M.S plates
6. Groove welding on M.S. plate in 1G,2G, 3G & 4G positions
7. Prepare and weld pipes in1G,2G, 5G & 6G positions by SMAW & GTAW
8. Prepare and fit pipes for T, Y, K joints and weld by SMAW
9. Welding of pipe by GMAW
10. Inspect and test welds by using Non-destructive Testing method - PT

Employment opportunities:

On successful completion of this course, the candidates shall be gain fully employed in the following sectors of industries:

1. Tubular Structure Fabrication like Roof and Building construction.
2. Site construction activities for power stations, process industries and mining.
3. Service industries like road transportation and Railways.
4. Ship building and repair
5. In public sector industries like HAL, BHEL,BEML, NTPC, etc. and private industries in India and abroad.
6. Petrochemical industries like ONGC,IOCL,HPCL etc
7. Offshore oil exploration, processing and cross country pipe lines
8. Self employment

Further learning pathways:

- On successful completion of the course trainees can opt for additional NCVT certificates in the following courses by doing the second semester since the first semester is common for all welder courses.

  WELDER,
  WELDER (GTAW &GMAW),
  WELDER (STRUCTURAL),
  WELDER (FABRICATION&FITTING),
  WELDER (WELDING & INSPECTION)
- Also on successful completion of the course they can pursue Apprenticeship training in the reputed Industries / Organisations.

SYLLABUS FOR TRADE PRACTICAL AND TRADE THEORY

SEMESTER-I

Week No	Trade Practical		Trade Theory
1	F-01 F-02	- Induction training: - Familiarisation with the Institute. - Importance of trade Training - Machinery used in the trade. - Introduction to safety equipment and their use etc. - Hack sawing, filing square to dimensions. - Marking out on MS plate and punching .	- General discipline in the Institute - Elementary First Aid. - Importance of Welding in Industry - Safety precautions in Shielded Metal Arc Welding, and Oxy-Acetylene Welding and Cutting.
2		- Setting up of Arc welding machine & accessories and Striking an arc - Setting of oxy-acetylene welding equipment, Lighting and setting of flame.	- Introduction and definition of welding. - Arc and Gas Welding Equipments, tools and accessories . - Various Welding Processes and its applications . - Arc and Gas Welding terms and definitions.
3	OAW-01 OAW-02 OAGC-01	- Fusion run without and with filler rod on M.S. sheet 2 mm thick in flat position. - Edge joint on MS sheet 2 mm thick in flat position with out filler rod. - Marking and straight line cutting of MS plate. 10 mm thick by gas.	- Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. - Types of welding joints and its applications. Edge preparation and fit up for different thickness. - Surface Cleaning
4	SMAW-01 SMAW-02	- Straight line beads on M.S. plate 10 mm thick in flat position. - Weaved bead on M. S plate 10mm thick in flat position.	- Basic electricity applicable to arc welding and related electrical terms & definitions. - Heat and temperature and its terms related to welding - Principle of arc welding. And characteristics of arc .
5	OAW-03 SMAW-03	- Square butt joint on M.S. sheet 2 mm thick in flat Position . - Fillet "T" joint on M.S. Plate 10 mm thick in flat position.	- Common gases used for welding & cutting, flame temperatures and uses. - Chemistry of oxy-acetylene flame. - Types of oxy-acetylene flames and uses. - Oxy-Acetylene Cutting Equipment principle, parameters and application.
6	OAGC-02 OAW-04 SMAW-04	- Beveling of MS plates 10 mm thick. By gas cutting. - Open corner joint on MS sheet 2 mm thick in flat Position - Fillet lap joint on M.S. plate 10 mm thick in flat position.	- Arc welding power sources: Transformer, Motor Generator set, Rectifier and Inverter type welding machines and its care & maintenance.. - Advantages and disadvantages of A.C. and D.C. welding machines
7	OAGC-03 OAW-05 SMAW-05	- Circular gas cutting on MS plate 10 mm thick by profile cutting machine. Fillet "T" joint on MS sheet 2 mm thick in flat position - Open Corner joint on MS plate 10 mm thick in flat position.	- Welding positions as per EN &ASME : flat, horizontal, vertical and over head position. - Weld slope and rotation. - Welding symbols as per BIS & AWS.

8	OAW-06 SMAW-06	- Fillet Lap joint on MS sheet 2 mm thick in flat position. - Single "V" Butt joint on MS plate 12 mm thick in flat position (1G) .	- Arc length – types – effects of arc length. - Polarity: Types and applications.
9	OAW-07 SMAW-07 SMAW-08	- Square Butt joint on M.S. sheet. 2 mm thick in Horizontal position . - Straight line beads and multi layer practice on M.S. Plate 10 mm thick in Horizontal position. - Fillet " T" joint on M.S. plate 10 mm thick in Horizontal position.	- Calcium carbide properties and uses. - Acetylene gas properties and generating methods. - Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor
10	OAW-08 SMAW-09	- Fillet Lap joint on M.S. sheet 2 mm thick in horizontal position . - Fillet Lap joint on M.S. plate 10 mm thick in horizontal position .	- Oxygen gas and its properties - Production of oxygen by Air liquefaction . - Charging process of oxygen and acetylene gases - Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. - Gas regulators, types and uses.
11	OAW-09 OAW-10 SMAW-10	- Fusion run with filler rod in vertical position on 2mm thick M.S sheet - Square Butt joint on M.S. sheet. 2 mm thick in vertical position - Single Vee Butt joint on M.S. plate 12 mm thick in horizontal position (2G). -	- Oxy acetylene gas welding Systems (Low pressure and High pressure). Difference between gas welding blow pipe(LP & HP) and gas cutting blow pipe - Gas welding techniques. Rightward and Leftward techniques.
12	SMAW- 11 OAW-11 SMAW-12	- Weaved bead on M.S Plate 10mm in vertical position. - Fillet "T" joint on M.S sheet 2 mm thick in vertical position . -Fillet "T" joint on M.S. plate 10 mm thick in vertical position.	- Arc blow – causes and methods of controlling. - Distortion in arc & gas welding and methods employed to minimize distortion - Arc Welding defects, causes and Remedies.
13	OAW-12 SMAW-13	- Structural pipe welding butt joint on MS pipe Ø 50 and 3mm WT in 1G position. - Fillet Lap joint on M.S. Plate 10 mm in vertical position.	- Specification of pipes, various types of pipe joints, pipe welding positions, and procedure. - Difference between pipe welding and plate welding.
14	SMAW-14 OAW-13	- Open Corner joint on MS plate 10 mm thick in vertical position. -Pipe welding - Elbow joint on MS pipe Ø 50 and 3mm WT.	- Pipe development for Elbow joint, "T" joint, Y joint and branch joint - Manifold system
15	OAW-14 SMAW-15	- Pipe welding "T" joint on MS pipe Ø 50 and 3mm WT. - Single "V" Butt joint on MS plate12 mm thick in vertical position (3G) .	- Gas welding filler rods, specifications and sizes. - Gas welding fluxes – types and functions. - Gas Brazing & Soldering : principles, types fluxes & uses - Gas welding defects, causes and remedies.
16	OAW-15	- Pipe welding 45 ° angle joint on MS pipe Ø 50 and 3mm WT.	- Electrode : types, functions of flux, coating factor, sizes of electrode Coding of electrode as per BIS, AWS,

	SMAW-16	- Straight line beads on M.S. plate 10mm thick in over head position.	- Effects of moisture pick up. - Storage and baking of electrodes. - Special purpose electrodes and their applications.
17	SMAW-17 SMAW-18	- Pipe Flange joint on M.S plate with MS pipe Ø 50 mm X 3mm WT - Fillet "T" joint on M.S. plate 10 mm thick in over head position.	- Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.
18	SMAW-19 SMAW-20	- Pipe welding butt joint on MS pipe Ø 50 and 5 mm WT. in 1G position. - Fillet Lap joint on M.S. plate 10 mm thick in over head position.	- Classification of steel. - Welding of low, medium and high carbon steel and alloy steels.
19	SMAW-21 SMAW-22	- Single "V" Butt joint on MS plate 10mm thick in over head position(4G) - Pipe butt joint on M. S. pipe Ø 50mm WT 6mm (1G Rolled).	- Effects of alloying elements on steel - Stainless steel : types- weld decay and weldability.
20	OAW-16 SMAW -23 OAW-17	- Square Butt joint on S.S. sheet. 2 mm thick in flat position. - Square Butt joint on S.S. Sheet 2 mm thick in flat position. - Square Butt joint on Brass sheet 2 mm thick in flat position.	- Brass – types – properties and welding methods. - Copper – types – properties and welding methods.
21	OAW-18 SMAW-24 AG-01	- Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing. - Single "V" butt joint C.I. plate 6mm thick in flat position. - Arc gouging on MS plate 10 mm thick.	- Aluminium and its alloys, properties and weldability, Welding methods - Arc cutting & gouging,
22	OAW-19 OAW-20	- Square Butt joint on Aluminium sheet. 3 mm thick in flat position . - Bronze welding of cast iron (Single "V" butt joint) 6mm thick plate	- Cast iron and its properties types. - Welding methods of cast iron.
23	**Industrial Training / Project Work**		
24	**Industrial Training / Project Work**		
25	**Revision**		
26	**Examination**		

Abbreviations:

SMAW - Shielded Metal Arc Welding
OAW - Oxy-Acetylene gas Welding
OAGC - Oxy-Acetylene Gas Cutting
F - Fitting
WT - Wall Thickness**.**

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SYLLABUS FOR TRADE PRACTICAL AND TRADE THEORY
SEMESTER-II

Week No	Trade Practical		Trade Theory
1		- Familiarisation with the machinery used in the trade - Cutting practice on M.S. plates using gas cutting methods - Cutting practice of M.S. plates using plasma cutting methods - Gouging practice	- Outline of the subjects to be covered - Importance of pressure vessels and pipe welding - Gas cutting & plasma cutting - Safety in welding
2		- Edge preparation for plate groove welding - Fit up of joints by tack welding using simple fixtures - Pipe and plate flange joint welding T & Y pipe joint welding	- Principles of Shielded Metal Arc Welding (SMAW) - Types of power source - Polarity type and arc length - Welding positions and importance
3	SMAW -01	- Groove welding on plate in 1G & 2G positions - Inspection and clearance using LPI testing during Root pass and cover pass	- Edge preparation and tack welding procedure - Welding fixtures and clamps
4	SMAW -02	- Groove welding on plate in 3G positions - Inspection and clearance using LPI testing during Root pass and cover pass	- Electrodes - types - description and specification - BIS, AWS, etc. - Functions of flux and characteristic of flux
5	SMAW -03	- Groove welding on plate in 3G positions - Inspection and clearance using LPI testing during Root pass and cover pass	- Selection of electrodes (Rutile / Cellulosic / Low hydrogen etc.) & coating factors - Electrode storage and backing temperature
6	SMAW -04	- Groove welding on plate in 4G positions - Inspection and clearance using LPI testing during Root pass and cover pass	- Types of metals and their characteristics - Classification of steels
7	SMAW -05	- Groove welding on plate in 4G positions - Inspection and clearance using LPI testing during Root pass and cover pass	- Introduction to pipe welding - Types of pipes and pipe schedule - Preparation work before welding
8	SMAW -06	- Preparation of pipe joint for pipe welding (schedule 40) - Prepare the edges , Clean the joint surfaces, Fit up the pipes and tack weld the pipes - Fit up inspection	- Basic pipe welding procedure - uphill welding, down hill welding and horizontal welding
9	SMAW -07	- Welding of pipes (schedule 40) in 1G position - Inspection and clearance using LPI testing during Root pass and cover pass	- Pipe welding position 1G, 2G, 5G & 6G
10	SMAW -08	- Welding of pipes(schedule 40) in 2G position - Inspection and clearance using LPI testing during Root pass and cover pass	- Selection of electrode (SMAW) for root pass and cover pass welding - Procedure for welding heavy wall pipes in 5G position welding.
11	SMAW -9	- Root welding of pipes(schedule 40) in 5G position - Intermediate and cover pass welding in 5G points	- Procedure for welding heavy wall pipes in 6G position welding - Welding symbols

		- Inspection and clearance using LPI testing	
12	SMAW -10	- Root welding of pipes (schedule 40) in 5G position - Intermediate and cover pass welding in 5G points - Inspection and clearance using LPI testing	- Procedure for welding of thin wall pipes in downhill position - Procedure for welding pipes in 2G position
13	GTAW -01 GTAW -02 GTAW -03	- Beading practice by TIG on MS sheets - Square butt joint on M.S. sheet in flat position - Square butt joint on M.S. plate in flat position - Inspection and clearance using LPI testing	- Welding procedure for complicated pipe joint, T-joints with intersection - Top, Bottom and Side - Y joint etc.
14	GTAW -04 GTAW -05	- Square butt joint on M.S. plate in 2G position - Inspection and clearance using LPI testing - Square butt joint on M.S. plate in 3G position - Inspection and clearance using LPI testing	- Introduction to GTAW welding - Advantages, Equipment - Electrode -
15	GTAW -06	- Square butt joint on M.S. plate in 4G position - Inspection and clearance using LPI testing	- Shielding Gas and Advantage of root pass welding by GTAW
16	GTAW -07 GTAW -08	- Root pass welding of pipes(schedule 40) 1G positions by TIG - Inspection and clearance using LPI testing - Root pass welding of pipes (schedule 40) 2G positions by TIG - Inspection and clearance using LPI testing	- Importance of preheating, post heating and post weld heat treatment - Welding metallurgy - weld stress - Distortion and control. - Correction of distorted section
17	GTAW -09 GTAW -10 GTAW -11	- Root pass welding of pipes (schedule 60) 5G positions by TIG - Inspection and clearance using LPI testing - Root pass welding of pipes (schedule 60) 6G positions by TIG - Inspection and clearance using LPI testing - Pipe welding dia 50mm in 2G position by GTAW	- Introduction to GMAW & Flux cored arc welding –Equipment, accessories, Advantages and Limitations
18	GTAW -12 SMAW -10	- Root pass welding of pipes (schedule 60) 6G positions by TIG - Inspection and clearance using LPI testing - Cover pass Intermediate pass by SMAW - Inspection and clearance using LPI testing	- Power source - Wire feeder - Electrode wires - shielding gases - Types of metal transfer and welding parameters
19	SMAW -11 SMAW -12	- Root pass welding of pipes (schedule 80) 6G positions by SMAW (by pipe welding electrode) - Inspection and clearance using LPI testing - Cover pass Intermediate pass by SMAW (by low hydrogen electrode) - Inspection and clearance using LP testing	- Types of welding defects, cause and remedy - Non-destructive testing methods
20	GMAW-01 GMAW-02 GMAW-03	- Beading practice by GMAW on MS plates - Square butt joint on M.S. sheet in flat position - Single V joint on M.S. plate in flat position - Inspection and clearance using LP testing	- Requirement for qualification in different codes - Qualification procedure under various codes - Different tests and inspection involved in qualification
21	GMAW-04 GMAW-05	- Pipe (schedule 40) welding by GMAW in 1G position . - Pipe (schedule 60) welding by GMAW in 1G position .	- Inspection and testing of weldments - Visual inspection kits and Gauges

22		- Dimensional inspection of weldments - Visual inspection of weldments - Non-destructive testing of weldments - Bend Testing of specimen according to codes and standards	- Pressure welding codes and standards (IBR, ASME etc.) - Writing procedure for WPS and PQR - Grouping of metals and filler rods (P & F number)
23	**Industrial training / Project work**		
24	**Industrial training / Project work**		
25	**Revision**		
26	**Examination**		

Abbreviations:

SMAW - Shielded Metal Arc welding
GTAW - Gas Tungsten Arc Welding
GMAW - Gas Metal Arc Welding
Schedule 40 Pipe = Min. Dia 100mm & Wall thickness 4mm to 6mm
Schedule 60 Pipe = Min. Dia 100mm & Wall thickness 6mm to 8mm
Schedule 80 Pipe = Min. Dia 150mm & Wall thickness 10mm to 13mm

LIST OF TOOLS & EQUIPMNT
FOR SEMISTER I &II

Tools & Equipments for a batch 16Trainees + one

Consumable kit

SI. No.	Name of the items	Quantity
1	Leather Hand Gloves 14”	17 pairs .
2	Cotton hand Gloves 8”	17 pairs
3	Leather Apron leather	17 nos.
4	S.S Wire brush 5 rows and 3 rows	17 nos.each
5	Leather hand sleeves 16”	17 pairs
6	Safety boots for welders	17 pairs
7	Leg guards leather	17 pairs
8	Rubber hose clips 1/2"	20 nos
9	Rubber hose oxygen 8 mm dia X 10 Mts long as per BIS	2 nos
10	Rubber hose acetylene 8 mm dia X 10 Mts long as per BIS	2 nos
11	Arc welding cables multi cored copper 400/ 600 amp as per BIS	45 mts each
12	Arc welding single coloured glasses 108 mm x 82 mm x 3 mm. DIN 11A &12 A	34 nos.
13	Arc welding plain glass 108 mm x 82 mm x 3 mm.	68 nos
14	Gas welding Goggles with Colour glass 3 or 4A DIN	34 nos
15	Safety goggles plain	34 nos
16	Spark lighter	6 nos
17	AG 4 Grinding wheels	10 nos

Trainees Tools Kit

SI. No.	Name of the items	Quantity
1	Welding helmet fiber	17 nos.
2	Welding hand shield fiber	17 nos.
3	Chipping hammer with metal handle 250 Grams	17 nos.
4	Chisel cold flat 19 mm x 150 mm	17 nos.
5	Centre punch 9 mm x 127 mm	17 nos.
6	Dividers 200 mm	17 nos.
7	Stainless steel rule 300mm	17 nos.
8	Scriber 150 mm double point	17 nos.
9	Flat Tongs 350mm long	17 nos.
10	Hack saw frame fixed 300 mm	17 nos.
11	File half round bastard 300 mm	17 nos.
12	File flat 350 mm bastard	17 nos.
13	Hammer ball pane 1 kg with handle	17 nos.
14	Tip Cleaner	17 nos.
15	Try square 6”	17 nos

General Machinery Shop outfit

SI. No.	Name and Description of Tools	Quantity
16	Spindle key	4
17	Screw Driver 300mm blade and 250 mm blade	1 each
18	Number punch 6 mm	2 set
19	Letter punch 6 mm	2 set
20	Magnifying glass 100 mm . dia	2 nos
21	Universal Weld measuring gauge	2 nos
22	Earth clamp 600A	6 nos
23	Spanner D.E. 6 mm to 32mm	2 sets
24	C-Clamps 10 cm and 15 cm	2 each
25	Hammer sledge double faced 4 kg	1
26	S.S tape 5 meters flexible in case	1
27	Electrode holder 600 amps	6
28	H.P. Welding torch with 5 nozzles	2 sets
29	Oxygen Gas Pressure regulator double stage	2
30	Acetylene Gas Pressure regulator double stage	2
31	CO_2 Gas pressure regulator, with flow meter	1 set
32	Argon Gas pressure regulator with flow meter	2 set
33	Metal rack 182 cm x 152 cm x 45 cm	1
34	First Aid box	1
35	Steel lockers with 8 Pigeon holes	2
36	Steel almirah / cupboard	2
37	Black board and easel with stand	1
38	Flash back arrester (torch mounted)	4 pairs
39	Flash back arrester (cylinder mounted)	4 pairs
40	Auto Darkening Welding Helmet	2 nos.

General Installation

41	Welding Transformer with all accessories (400A , OCV 60 – 100 V, 60% duty cycle)	2 sets
42	Welding Transformer or Inverter based welding machine with all accessories (300A , OCV 60 – 100 V, 60% duty cycle)	2 sets
43	D.C Arc welding rectifiers set with all accessories (400 A. OCV 60 – 100 V, 60% duty cycle)	2 sets
44	GMAW welding machine 400A capacity with air cooled torch, Regulator, Gas preheater, Gas hose and Standard accessories	1 set
45	AC/DC GTAW welding machine with water cooled torch 300 A, Argon regulator, Gas hose, water circulating system and standard accessories.	2 set
46	Air Plasma cutting equipment with all accessories, capacity to cut 25 mm clear cut	01 set
47	Air compressor suitable for air plasma cutting system	01 no
48	Pipe beveling machine	01 no
49	Universal Testing machine	Optional
50	Pug cutting machine Capable of cutting Straight & Circular with all accessories	01 set
51	Pedestal grinder fitted with coarse and medium grain size grinding wheels dia. 300 mm	1

52	Bench grinder fitted with fine grain size silicon carbide green grinding wheel dia. 150 mm	1
53	AG 4 Grinder	2 Nos
54	Suitable gas welding table with fire bricks	2 Nos
55	Suitable Arc welding table with positioner	9
56	Trolley for cylinder (H.P. Unit)	2
57	Hand shearing machine capacity to cut 6 mm sheets and flats	1
58	Power saw machine 18''	1
59	Portable drilling machine (Cap. 6 mm)	1
60	Oven, electrode drying 0 to 350°C, 10 kg capacity	1
61	Work bench 340x120x75 cm with 4 bench vices of 150 mm jaw opening	4 sets
62	Oxy Acetylene Gas cutting blow pipe	2 sets
63	Oxygen, Acetylene Cylinders	2 each*
64	CO_2 cylinder	1 No *
65	Argon gas cylinder	1 No *
66	Anvil 12 sq. inches working area with stand	1 No.
67	Swage block	1 No.
68	Die penetrant testing kit	1 set
69	Magnetic particle testing Kit	1 set
70	Fire extinguishers (foam type and CO_2 type)	1
71	Fire buckets with stand	4 nos
72	Portable abrasive cut-off machine	1 No
73	Centre lathe swing over dia 10"	Optional
74	Suitable gas cutting table	1 No
75	Welding Simulators for SMAW/GTAW/GMAW	1 each (Optional)

NOTE:

1. * Optionally Gas cylinders can also be hired as and when required
2. No additional items are required to be provided for unit or batch working in the Second shift except the items under trainee's tool kit and steel lockers.

Class Room Furniture for Trade Theory

Sl. No	Names & Description of Furniture	Quantity
1	Instructor's table and Chair (Steel)	1 set
2	Students chairs with writing pads	16
3	White board size 1200mm X 900 mm	1
4	Instructors lap top with latest configuration pre loaded with O.S and MS Office package.	1
5	LCD projector with screen.	1
6	Welding Process, Inspection & codes DVD/ CDs	1 set each (optional)

LIST OF TRADE COMMITTEE MEMBERS

Sl. No	Names & Designation	Organisation	Remarks
Members of Sector Mentor council			
1	Dr.G.Buvanashekaran	AGM, WRI, Trichy - Chairman	Chairman
2	Dr.K.Ashokkumar	AGM, BHEL, Trichy	Member
3	Prof. Jyothi Mukhopadhya	IIT, Ahmedabad	Member
4	B.Pattabhiraman	MD, GB Engineering, Trichy	Member
5	Dr.Rajeev kumar	IIT, Mandi	Member
6	Dr. Vishalchauhan	IIT, Mandi	Member
7	Shri D.K.Singh	ITI, Kanpur	Member
8	Shri. Navneet Arora	IIT, Roorkee	Member
9	Shri. R. K. Sharma	Head, SDC, JBM Group, Faridabad	Member
10	Shri. Puneet Sinha	Deputy Director, MSME, New Delhi	Member
Mentor			
1	Shri. Deepankar Mallick	Director of Training, DGE&T Hq,	Mentor
Members of Core Group			
1	Shri. M Thamizharasan	JDT, CSTARI, Kolkata	Member
2	Shri. M Kumaravel	DDT, FTI , Bangalore	Team Leader
3	Shri. SushilKumar	DDT, DGE&T Hq,	Member
4	Shri. S.P.Khataokar	T.O. ATI, Mumbai	Member
5	Shri. V.L. Ponmozhi	TO, CTI, Chennai	Member
6	Shri. D.Pani	TO, ATI, Howrah	Member
7	Shri. Amar Singh	TO, ATI, Ludhiyana	Member
8	Shri. Gopalakrishnan	TO, NIMI, Chennai	Member
9	Shri. Manjunatha B.S	JTO, GITI, K.G.F. Karnataka	Member
10	Shri. Venugopal PC	ITI Chalakudi, Kerala	Member