260 – PLUMBING AND PIPE FITTING

Examination Structure

The examination for this syllabus will cover three major areas of groupings with 193 – Building Engineering and 191 – General Metal Work as trade-related courses.

211 - (CBC 11) (See under building trade)
261 - Plumbing and Pipe fitting (CWS 11 and 12)

In each of the groupings there will be objective and essay.

Candidate will be examined in practical covering only the last two groupings of modules CWS 11,CWS 12, CWS 10 and CSD 11.

Examination Scheme.

Introduction to Building Construction

211-1 PAPER 1

SECTION A- OBJECTIVE: This paper will be a multiple choice objectives questions for 40 items candidates are to answer all questions in 40 minutes for 40 marks.

SECTION B: ESSAY: This will be a written paper of 6 essay questions. Candidates are to answer 5 questions in 2 hours for 60 marks.

261 – Plumbing and Pipe Fitting

261-1 PAPER 1:

SECTION A: OBJECTIVES: This consists of 40 multiple choice Objective questions to be attempted in 40 minutes for 40 marks.

SECTION B: ESSAY: This will be a written paper if 6 Essay questions out of which candidates are to answer 5 questions in 2 hours for 60 marks.

261-2 PAPER 11:

PRACTICAL: There will be a practical test and candidates are required to attempt 6 hours and it carries 100 marks

PLUMBING AND PIPE FITTING (CSD 11 & 12)

S/N	Topic/Objective	Contents	Activities/Remarks
1	**Safety Precautions** Apply appropriate safety precautions in movement and storage of gas welding equipment and use protective wears during welding operations	1. Movement and storage of cylinders - safety precautions - operations 2. Care for all the safety devices - welding goggles - welding shields - gloves - boots etc 3. Application of safety precaution in carrying out. - gas welding on empty cylinders of chemicals, inflammable or explosive liquids. - Gas welding on inflammable materials, e.g. petrol tanks - Gas welding on confined spaces	1. Demonstrate by showing how the gas cylinders are moved from one place to another and their storage. 2. also demonstrate the use of all safety devices in welding.
2	**Gas Welding** 1. Identify and describe gas welding equipment and difference between high and low pressure welding 2. Generate acetylene and identity various welding rods and torches.	1. Gas welding equipment - description - functions - application - care, eg. - Generators - Regulators - Blow pipes - Nozzles - Hoses - Cylinders - Economizers etc 2. Acetylene generators - types of generators - parts of generator - low and high pressure system of welding - acetylene generation with calcium carbide - welding rods and their types - types of flames	1. Sketch the different gas and welding equipment considering their colours 2. Connect the equipment with the necessary fittings. 3. Explain with sketches the two main acetylene generators - Empty an acetylene generator and recharge it - Cut and perform a welding exercise on a specified pieces of metal. Cut a metal to specified dimensions and weld with or without filler rods. Weld two pieces of metals in both down hand and flat

S/N	Topic/Objective	Contents	Activities/Remarks
		- welding and cutting torches	positions for the following joints. - butt joint - fillet joint - lap joint etc
	3. Identify welding flames and apply on prepared plate surface to run beads	3. Main parts of generator - hydraulic back - pressure valve - carbide trays - over flow valves etc 4. Difference between high and low pressure system of welding. 5. Properties of calcium car-bide 6. Generating acetylene - their properties - composition - uses 7. Difference between welding and cutting torches	
	4. Make sketches of various welding symbols and apply different techniques of joining metals.	8. welding and cutting torches 9. Instance of application and uses of flames named above 10. Lighting and adjusting flame to each type 11. preparation of place surfaces to run beads 12. Sketches indicating the conventional symbols for the welded joint.	
	5. State functions and use backing bar and strips to weld	13. Preparation of plate surfaces for welding the following joints - butt joint - fillet joint - lap joint 14. Welding metals in down hand or flat position. - butt joint - fillet joint - lap joint 15. Functions of backing bar and strips and their applications 16. Welding metals in down hand or flat position. 17. Application of backing bars and strips during welding.	

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3.	**Manufacture and Storage of Gasses** Explain methods of manufacture and storage of oxygen and acetylene equipment observing necessary safety precautions.	1. Production of oxygen and acetylene - methods - equipment 2. Difference between the equipment for oxygen and acetylene 3. The safety precaution during - handling - storage - assembly and use	Visit gas production factory
4.	**Assembly of Oxygen and Acetylene Equipment** 1. Keep equipment in correct position and assemble the gas welding components 2. Test for leakage and state functions of the component	1. Positioning and securing the welding cylinders. 2. Cleaning the outlet of cylinders for foreign body and fix regulators 3. Correct hose pipes for fixing pressure regulators. 4. Fixing welding blow pipe to hose and attach to the correct nozzle. 5. Testing of complete assembled equipment.	1. Assemble a gas welding, set for welding. 2. Test for leakage; using soapy water.
5.	**Skills in Gas Welding** 1. Identify types, sizes and properties of welding rods and flames used in gas welding. 2. Light welding torch and apply the various flames on prepared plate surfaces and joints 3. Assemble, tack and carry out 0xy-acetylene welding with different	Functions of various components e.g. - regulators - blow pipes - nozzle - hoses etc. 1. Types and sizes of welding rods. 2. Properties and uses of welding rods 3. Lighting welding torch and adjusting flames e.g. - oxidizing flame - carbonizing flame - neutral flame 4. Identification of flames 5. Instances of application 6. Preparation of plate surface for running beads - with filer rods	Use the three types of flames to perform welding exercises for different joints. 3. Preparing various welding joints and apply both right and left ward welding techniques

S/N	Topic/Objective	Contents	Activities/Remarks
	techniques	- without filler rods 7. Preparing various welding joints e.g. - butt joint - fillet joint - lap joint. 8. Assembling and tack welding the metal. 9. Carryout 0xy-acetylene on materials applying left and rightward techniques.	
6.	**Brazing and Bronze Welding** 1. Differentiate between brazing/silver soldering and bronze welding and identify appropriate flames used for welding. 2. Prepare metal edges and carry out brazing operations observing necessary safety precautions. 3. Explain importance of brazing dissimilar metals	1. Difference between brazing and bronze welding: - flames and rods - joint preparation - importance of welding - dissimilar metals 2. Lighting flame necessary for successful brazing and bronze welding. 3. composition of various types of flames and filler rods used.. 4. Preparation of metal fans/edges brazing. 5. Brazing joints using oxyacetylene flame brazing lamp and safety precautions. 6. Preparing joints for bronze welding. 7. Carrying out bronze welding on prepared joints with safety precautions. 8. Importance of using bronze welding for welding of dissimilar metals, e.g. - copper and steel - cast iron and copper - galvanized materials.	Simple forms of soldering, silvered soldered and bronze welding joints on pipes
7.	**Welding Non-Ferrous Metals** 1. Identify non-ferrous metals and describe their	1. Non-ferrous metals - copper - aluminium - brass - bronze - composition and mechanical properties	Lay straight beads of weld on a specified piece of stainless steel using different techniques. Join two pipes using suitable

S/N	Topic/Objective	Contents	Activities/Remarks
	composition and properties. 2. State properties and compositions of fluxes used for welding nonferrous metal and apply appropriate flux on prepared component for welding. 3. Identify properties and composition of stainless steels and prepare the composition for welding. 4. Carry out welding operations using appropriate rods, techniques observing necessary safety precautions and effects of joining two different metals.	- flux for bronze welding nonferrous metals. Welding rods - welding techniques - importance of different metals and their uses. 2. Properties and compositions of fluxes and uses - ductility - malleability - hardness - tenacity etc 3. Preparation and welding of non-ferrous metals with appropriate fluxes. 4. Suitable flux for bronze welding and its composition. 5. Preparation of bronze components or welding, avoiding sharp edges and welding to specification. 6. Composition and properties of stainless steels used in metal work. 7. Preparing stainless steel components for welding. 8. Welding stainless steel components using rods with different techniques and safety precautions. 9. Effect of welding together different metals.	fluxes. Weld together two different metals or pipes.
8.	**Fuel Gas Cutting Process** 1. State principles with applications of fuel gas cutting process an describe types of fuel gasses use in oxy-fuel cutting, considering advantages and	1. Principles and applications of fuel-gas cutting process: - manual - machine 2. Various fuel gasses used in oxy-fuel cutting - acetylene - propane - butane - coal gas etc. 3. Advantages and disadvantages of the operations.	Carry out both manual and machine oxy-fuel cutting process

S/N	Topic/Objective	Contents	Activities/Remarks
	disadvantages of cutting operations.		
9.	**Welding Defect** 1. Identify welded joints defects with their causes and rectify them.	1. Welded joints defects - types of test - causes of defect - non-destructive test - destructive tests 2. Rectification of welding joint defects. 3. Main causes of welding defects in joints	1. Carry out both non-destructive test on a welded joint to determine if there are defects like blow holes, lack of penetration etc. 2. Rectify the defects
10.	**Liquefied Petroleum Gas** Explain methods of production and storage and state types and properties of liquid petroleum gases with necessary safety precautions.	1. Methods of production and storage of liquid petroleum gases. 2. Types of liquid petroleum gases and their properties 3. Safety precautions when storing and using L.P.G.	A visit to a petroleum production industry is necessary. Show various samples of the gasses and explain how they are produced.
11	**Bunsen Flames and Domestic Gas Installation** 1. Explain principles of flames and the common product. 2. Select types and functions of fittings and liquid petroleum gas and identify methods of installation. 3. Produce platforms for cylinders and install gas pipes to appliance and test for leakage	1. Simple principles of luminous and Bunsen flames. - combustion - oxidation 2. Common products of combustion and extinction – mechanical and natural. 3. Types of fittings and functions 4. Methods of gas installation. – advantages and disadvantages. 5. Construction and positioning plat forms for receiving gas cylinders. 6. Installation of gas pipe work to feed suitable appliances 7. Testing to detect leakages and defective fittings.	1. Carry out the following installation work: - gauge - thermostat - service pipes - valves - cookers - meters etc. 2. Visit a construction site where a domestic installation work is carried out 3. Carry out test for leakages.

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12	**Steam Generator** Identify types, functions of steam generator and explain its working principles.	1. Steam generator - Types of generators - Working principles - Function and design	Draw or sketch and name in detail parts of a steam generator
13	**Steam and Gas work** 1. Explain importance and usage of steam in industry and differentiate types of steam. 2. State purpose, types of insulation of steam pipes and fittings and insulate appropriate steam pipes and valves.	1. Importance and usage of steam in industry and differentiate types of steam. 2. Various types of steam - wet - dry - super heated with dacility 3. Purpose, types of insulation of steam pipes and fittings 4. Insulation of steam pipes 5. various types of pipes used for gas, water and steam installations. 6. Various types of valves and used in steam installations	1. By way of demonstration, install a steam pipe with its fillings and carry out necessary installation work. 2. A visit to industry using steam for production for processes work.
14	**Installation of Steam Pipes System** 1. Setout pipeline to point of use and fix bracket of clips for firm support. 2. Explain reasons for insulation and select and apply appropriate for installation with necessary tests	1. Setting out pipeline from source to point of use. 2. Fix clips or bracket along pipe lines for support 3. Laying of pipes on to bracket and securing firmly. 4. Joining steam pipe. 5. Reasons for insulating a steam pipe. 6. Suitable materials to insulate a steam pipe system. 7. Carrying out essential tests on competed work.	Install a steam pipe with adequate support and insulation.
15	**Sources and Properties of Water** Explain sources of water and state their	1. Sources of water in nature - wells - rainfall - rivers - bore holes - lakes etc.	Explain with examples different sources of getting water.

S/N	Topic/Objective	Contents	Activities/Remarks
	properties	2. Properties of Water - chemical - physical	
16	**Contamination of water** Identify sources of impurities in water with prevention and treatment to be carried out.	1. Impurities in water - ground water impurities - chemical 2. Prevention depending on the sources of supply 3. Types of water – hardness and softness - temporary - permanent 4. Treatment of water - using a base exchange water - filtering it with find sand - using a steam cloth - boiling	Name and describe types of water and how it is treated by way of demonstration. Visit to a water works is required.
17	**Layout Water Supply System** 1. Explain principles in layout of public an domestic water supply. 2. Select various materials used for pipe work and install with appropriate fittings, support and protections.	1. Principles involved in layout of public and domestic water supply with drawing. 2. Types of materials used for pipe work and their reaction to different types of water - cast iron - concrete - steel etc - PVC - Asbestos. 3. Installations of tanks and service main 4. Thread various sizes of pipes and fix the fittings, bending of pipes of various sizes	1. Draw and explain layout of public and domestic water supply system. 2. Thread and fix pipe fittings and test for water tightness 3. Install service mains and tank and test for efficiency. 4. Carry out simple support for trunk and service mains. 5. Carry out pipe bending to 45^0, 180^0 135^0 etc. Using heating sand loading spring methods and bending machines
18	**Constant and Intermittent System** 1. Explain principles of constant and	1. Principles of constant and intermittent system of public cold water supply. 2. Types/classes of pipes and their uses. 3. Methods of jointing and	Carry out the jointing of various pipes in the workshop Visit a construction site where installation of water

S/N	Topic/Objective	Contents	Activities/Remarks
	intermittent system of water supply and identify classes of pipes. 2. Select various jointing compound suitable for materials with their method of installing public cold water supply system	suitable compounds	pipes are made e.g. bathrooms, kitchen, toilet etc.
19	**Cold water supply** 1. Explain principles of direct and indirect water supply system and select appropriate fittings and valves required for connections	1. Principles of direct and indirect domestic cold water supply. 2. Pipe and fittings 3. Selection of pipes, valves and fittings 4. Installations of service pipes building stop cock, communication pipe and the boundary stop cock 5. Protection of pipes runs within buildings. 6. Various types of joints in domestic cold water supply e.g. - steel - copper - plastics 7. Need for support and protection 8. Direct and indirect water supply	Apply various methods e.g. protecting pipes in buildings. Also visit a site where servicing pipes and fittings are carried out Carry out jointing of different pipes with different methods
20	**Tap, Valves and Cocks** 1. Explain principles of taps, valves and cocks operation with sketches and carry out	1. Principles of operations - bib taps - globe taps - stop valves - plug cocks - pressure valves - gate valves - drain cocks	1. Draw and carry out some exercises on taps, valve and cocks on internal components 2. Try to install valves. 3. Install and protect domestic storage

S/N	Topic/Objective	Contents	Activities/Remarks
	appropriate installations. 2. Explain need for installing and protection.	- pillar taps 2. Sketching and labeling of valves, taps and cocks mentioned above 3. Installation of valves and taps in water supply cistern. 4. Importance of installation of domestic water storage system. 5. protection of storage cistern	cisterns and valves.
21	**Storage Tank** 1. Design simple support and select appropriate materials for constructing cold water supply cistern with installation. 2. Select suitable storage tank and reservoir	1. (a) Types of storage tank and their reservoir (b) Types of materials used for storage tank and reservoir their characteristic to water 2. (a) Design tank support (b) Design storage tanks, over head and underground 3. Construction materials - sheet metals - welding accessories etc. 4. Installation of tank 5. Types of support and protection required. – material and concrete tower	1. Produce a storage tank to a given specification. 2. Produce sample support to a given specification. 3. Construct a portable tank in the workshop 4. visit a nearby tank construction 5. Install storage tank and reservoir.
22.	Faults and Defects Identify types, causes of noises in cold water supply systems and repairs to be taken	1. Causes of noises in cold water and remedy. When the tap is shut, and suddenly the pressure is release, it flow and causes the noise, water hammer 2. Identification and remedy of faults e.g. - air locks - worn out valves - leakages etc.	Carry out a repair work on valves and taps.
23	**Rural Water Supply**	1. Sources of water supply in rural area e.g - wells	1. Draw and label parts of pumps. 2. Install pumps to wells

S/N	Topic/Objective	Contents	Activities/Remarks
	1. Explain sources of water supply and know types and principles of operating pumps. 2. Identify pumps and explain the importance and sitting of valves used in pumps.	- springs - streams - boreholes 2. (a) principles of operation and importance of pumps e.g. jack, lift, lift and force, pumps and hydraulic ram. (b) types of pumps – centrifugal, semi-rotary wind mill pump, double action life and free pump. 3. Sketching and labeling of lift, lift and force, semi-rotary pumps and hydraulic ram. 4. Importance and sitting of valves for pumps and maintenance	and boreholes.
24	**Safety in Hot Water Installation** 1. Explain main provisions of model and relevant local byelaws on hot water and state reasons for fixing safety valves. 2. Mention dangers in storage and use of fuels and reasons for installing thermometer in water heating system.	1. Model and relevant local bye-laws on hot water installation. 2. Safety devices and their functions 3. Risks in storing fuels – boiler and cylinders – leakage etc. 4. Reasons for installing thermometer in water heating system. 5. Causes of danger associated with boiler and cylinder. 6. Causes of noises in water supply system	1. Show how most of the valves are installed and their functions. 2. Install thermostat and water heating system. 3. List the risk involved in fuel storage and how to avoid them.
25	**Hot Water Installation** 1. Read and interpret blue print of public and domestic	1. Blue print of public and domestic cold and hot water supply system. - components - pipe work - safety and efficient	1 Try to fix one of the components as an example 2. Prepare piping drawing using scale rule. 3. Carry out complete installation of the hot

S/N	Topic/Objective	Contents	Activities/Remarks
	hot water with support components and connect pipes to the components. 2. Explain reasons for installation and test for safety and working system.	working of the system. 2. Components of the hot water installation e.g. boiler, feed tank and hot storage cylinder. 3. Necessary pipe work to the components. 4. Reasons for carrying out complete installation work. 5. Testing the complete hot water installation for safety and efficient working system.	water system e.g storage cylinder etc and test for efficiency.
26	**Install a Domestic Hot Water Supply** 1. Explain types of electric and gas water heaters and their working principles. 2. With ratings and efficiency, choose and install water heaters considering safety	1. (a) Types of water gas and electric heaters (b) Working principles. (c) Ratings and efficiency 2. Calculation of gas and electricity consumption. 3. Importance of knowledge of rating of common immersion and gas heaters. 4. Installation of water heaters e.g. back boilers. - independence boilers - instantaneous heaters etc. 5. Faults in hot water system installation	1. Organize and install one heater as an exercise. 2. Calculate a given gas heater capacity 3. Carry out installation if heaters and test for efficiency 4. Diagnose and rectify faults in hot water installations system Elementary knowledge of electricity is required.
27	**Sanitation Appliances** 1. Explain principles of sanitation in buildings and identify types of sanitary fittings with sketches. 2. Select materials and describe properties and production of waste and soil appliance. 3. Choose appropriate	1. principles of sanitation 2. types of sanitation fittings W.C. Bidet, slop sink wash hand basin, bath sink and urinals 3. Sketch label and dimension of soil and waste appliances 4. materials and processes involved in the manufacturing of soil and waste appliance, porcelain enameled store – ware, plastic, steel etc. 5. Properties and materials for manufacture. 6. Sanitary appliance in different buildings. 7. Sizes and various fixing	1. Sketch, label and dimension some sanitary appliances 2. Sketch a building plan and site all the necessary appliances

S/N	Topic/Objective	Contents	Activities/Remarks
	sizes of sanitary appliances and pipes and know where to fix them in buildings	levels. 8. Various sizes of pipes, e.g. 6mm, 13mm, 19mm	
28	**Install Sanitation Appliances** 1. Read and interpret drawings of sanitary installation in building plans. 2. Carry out preparation relevant to fixing sanitary appliances and test for leakages.	1. Drawings of sanitary installation in building plans. 2. Necessary preparation to fixing of sanitary appliance. 3. Fixing of sanitary appliance to given specification. 4. Test for leakages, security and efficiency etc	1. Install sanitary appliances in the workshop. Demonstrate in a workshop and test the systems for leakages, security and efficiency. 2. Prepare a detailed building plan and carry out plumbing design.
29.	**Traps** 1. Differentiate and describe various traps and their uses with sketches. 2. Explain functions of water seals in traps and state causes of unsealing and fix to sanitary system and tests for efficiency	1. Types of traps and their uses. 2. Sketching and describing different types of traps. 3. Seals in traps 4. Causes of unsealing and their remedies 5. Fixing traps to the sanitary system and tests of efficiency	Identify and fix traps to sanitary appliances.
30	**Waste and Soil pipes** 1. Select types of soil waste appliances and explain	1. Types of soil waste appliances. 2 Principles and arrangement of soil waste pipes above ground e.g. one pipe, dual pipe and single stack	1. Use various methods to install waste and soil pipes above ground level 2. Carry out installation of waste and soil pipes above ground level in the

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	principles and arrangement of soil waste pipes above ground 2. State materials used and install with necessary testing of soil and waste pipes above ground level.	3 Materials used for sizes of waste and soil pipes. 4 Installation and testing soil and waste pipes	workshop
31	**Drainage** 1. Identify types and basic principles of drainage considering building regulations installation. 2. State materials used for drainage system and determine sizes of drain pipes with appropriate drawings and sketches.	1. Basic principles of good drainage system 2. Plain provisions of building regulations with regard to domestic drainage. 3. Types of drainage system 4. Properties of materials used for drainage system 5. Sizes of drainage pipes 6. Simple drainage layout and drainage pipe sketch 7. Drainage below ground level	1. Sketch a simple drainage layout and indicate pipe joints, man-hole inspection chamber etc. 2. Carry out installation of waste and soil pipes below ground level on the site
32	**Septic Tank and Soak-Away** 1. With sketches, explain the purpose and principles of septic tank and soak-away pit. 2. Consider appropriate types and sizes of tank and soak-away and carry out necessary connections	1. Purpose of septic tank and soak-away pit 2 Principle of constructing septic tank and soak-away pit 3. Designing, drawing and calculation of standard septic tank and soak-away pit 4. Various recommended sizes of septic tank and soak-away based on design. 5 Connections of drainage system to septic tank and soak-away. 6 Importance of ventilation in septic tanks 7 Selecting appropriate types of	Draw a standard septic tank and soak-away pit used for domestic and small scale industrial uses. Visit a building where construction and connections of both septic and soak-away is taking place.

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		soak-away pit construction for various soils.	
33	**Cess Pool Drainage System** 1. State purpose of a cess pool and explain principles of its construction. 2. Consider requirements for a cess pool location and draw to scale a standard cess pool for domestic dwellings.	1. Purpose of a cess pool 2. Principles of its construction. 3. Requirements for location of a cess pool 4. Designing of a simple cess pool for domestic dwelling based on calculation	Design and carry out or sketch connections of the drainage system to cess pool.