COURSE TITLE: **Bricklaying and Concreting**

COURSE LEVEL: Craft Certificate

PRE-REQUISITE: Requirements for this course are as follows:-

(a) Applicants for the full time course must be 15 years And over, those for the part time course must be 18 years and over
(b) Applicants must complete a Primary education and at least two years of Secondary school education.

COURSE DURATION: The duration of the course is two (2) years for full time students

And three years for part time students.

COURSE PURPOSE This course is designed to provide the essential requirements for the students who will become a competent craftsman by building models in workshop and by doing the actual job on the work site.

COURSE DESCRIPTION: Upon completion of this course the students will:

- Demonstrate bricklaying.
- Select and use tools.
- Select clay and concrete bricks.
- Distinguish types of motars.
- Perform jointing and pointing of brickwork.
- Demonstrate setting out and levelling.
- Select footing and foundation.
- Select D.P.C. materials.
- Erect tubular scaffolding.
- Construct cavity walls.
- Describe methods of bridging openings.
- Apply methods of construction for solid ground floor.
- Demonstrate arch construction.
- Define concrete.
- Excavate end timber trenches.
- Identify materials for paving.
- Tile wall and floor.
- Demonstrate job organisation.
- Recall bricklaying and concreting terms.
- Demonstrate wall construction.
- Identify the purpose of copings.
- Apply plaster to walls.
- Describe lime and cements.
- Define reinforced concrete.
- Fixing timber frames to brick and block walls.

- Apply floor finishes.
- Use vulgar and decimal fractions.
- Use S.I. units.
- Calculate averages, percentages and ratios.
- Calculate perimeters and areas of plane figures.
- Calculate areas of triangles.
- Calculate volume.
- Calculate square and square roots.
- Use logarithm to solve problems.
- Apply properties of the right-angled triangle.
- Apply circumference and area of circle.
- Transpose formulae.
- Solve simple equations.
- Calculate foundation size.
- Conduct estimates.
- Observe effects of water.
- Identify properties of materials.
- Define efflorescence.
- Define condensation.
- Locate metal corrosion.
- Test aggregates.
- Test temperature and expansion.
- Demonstrate transfer of heat.
- Describe lifting tackle.
- Demonstrate mechanics of beam.

INSTRUCTIONAL TECHNIQUES: - The techniques to be used in this course will involve the following.

- Chalk and talk.
- Distribution of handouts.
- Display of charts and models.
- Use of overhead projector.

ASSESSMENT AND EVALUATION: - Students will be assessed by class tests, home work and assignments.

- 50% of marks for theory.
- 50% of marks for practical.

1. **DEMONSTRATE BRICK BONDING**:
   - (i) Define the term bonding.
   - (ii) State the purpose of bonding.
   - (iii) State the principles of bonding.
   - (iv) Explain the term broken bond.
   - (v) Describe the principal types of bond.
   - (vi) Sketch the principal bonds etc.

2. **SELECT AND USE TOOLS**:
   - (i) Select the tools for a specific job.
   - (ii) Describe the various tools.
   - (iii) Use tools for the purposes only.
   - (iv) Care tools.
   - (v) Sketch tools.
   - (vi) Maintain tools etc.

3. **SELECT CLAY AND CONCRETE BRICKS**:
   - (i) Classify bricks and blocks.
   - (ii) Describe the method of manufacture.
   - (iii) State the characteristics of bricks.
   - (iv) Specify the standard sizes.
   - (v) State the reasons for curing
   - (vi) Describe the methods of burning bricks.
   - (vii) State the uses of the various bricks and blocks.
   - (viii) Sketch types of bricks and blocks.

4. **DISTINGUISH TYPES OF MORTARS**:
   - (i) Explain the term mortar.
   - (ii) State the characteristics of mortar.
   - (iii) Specify suitable ratio for mortar mixes.
   - (iv) State the types of mortars.

5. **PERFORM JOINTING AND POINTING OF BRICKWORK**:

(i) Explain the term jointing and pointing.
(ii) State the advantages and disadvantages of jointing.
(iii) State the disadvantages of pointing.
(iv) Describe the procedure of pointing.
(v) Describe the types of pointing.
(vi) Sketch the types of pointing.
(vii) List the tools for pointing a wall with a weather struck and recessed joint.

6. **DEMONSTRATE SETTING OUT AND LEVELLING**:

(i) Describe the methods of setting out a right angle.
(ii) Explain Building Line and Frontage Line.
(iii) Describe the procedure of setting out.
(iv) Erect profiles.
(v) Sketch the types of profiles.
(vi) Explain the term datum level.
(vii) Use boning rods.
(viii) Sketch boning rods.
(ix) Explain the 3:4:5 method etc.

7. **SELECT FOOTING AND FOUNDATION**:

(i) Explain the term footing course.
(ii) State the purpose of footing course.
(iii) State the type of bond used for footing courses.
(iv) Sketch footing course.
(v) Explain the term foundation.
(vi) Sketch the purposes of foundation.
(vii) Sketch the factors governing the size of a foundation.
(viii) State the minimum thickness of a concrete foundation.
(ix) State the types of foundations.
(x) Sketch the types of foundations.

8. **SELECT D.P.C. MATERIALS**:

(i) Explain the term D.P.C.
(ii) State the purpose of a D.P.C.
(iii) Classify materials used as D.P.C.
(iv) State the minimum distance of a D.P.C. from ground level etc.

9. **ERECT TUBULAR SCAFFOLDING**:
   (i) Explain the term scaffolding.
   (ii) Describe the building regulations which specifies basic scaffolding requirements.
   (iii) Name the parts of a scaffold.
   (iv) State the types of scaffold.
   (v) Sketch dependent, independent and tower scaffolds etc.

10. CONSTRUCT CAVITY WALLS:
   (i) Explain the term cavity wall.
   (ii) State the advantages of a cavity wall.
   (iii) State the size of the cavity.
   (iv) Sketch cavity wall.
   (v) Place the wall ties at correct distances.
   (vi) Describe methods of keeping the cavity clean.
   (vii) Sketch the various cavity wall ties.

11. **DESCRIBE METHODS OF BRIDGING OPENINGS**:
   (i) State the purpose of openings.
   (ii) State the methods of bridging openings.
   (iii) Explain the term neutral axis.
   (iv) Sketch a reinforced concrete lintel.
   (v) Describe methods of supporting a brick lintel>
   (vi) Describe the procedure of building a brick lintel.

12. APPLY METHOD OF CONSTRUCTION FOR SOLID GROUND FLOOR:
   (i) State the minimum thickness of concrete for solid ground floor.
   (ii) Place D.P.C. at a level not less than 150mm above the highest level of the surface of the ground.
   (iii) Specify suitable mix for the ground floor.
   (iv) Sketch solid ground floor.
   (v) State the reason for curing the ground floor.

13. **DEMONSTRATE ARCH CONSTRUCTION**:
    (i) Explain the term arch.
    (ii) State the purpose of an arch.
    (iii) Describe arch terms.
    (iv) Classify arches.
    (v) Explain the difference between a turning piece and an arch centre.
    (vi) Position centre.
    (vii) Remove centre.
    (viii) Construct the many types of arches.
    (ix) Sketch segmental and semi-circular arches
    (x) Name the parts of an arch.

14. **DEFINE CONCRETE**:
    (i) Explain the term concrete.
    (ii) State the properties of fresh and hardened concrete.
    (iii) Specify suitable ratio for missing concrete.
    (iv) Store cements and aggregates on site.
    (v) State methods of mixing concrete.
    (vi) Explain the term of w/c ratio.
    (vii) Outline the difference between volume batching and weigh-batching.
    (viii) Describe methods of transporting concrete.
    (ix) Describe various methods of compacting concrete.
    (x) State the various ways in which curing may be carried out on the site.
    (xi) Describe a suitable test for the work ability of concrete.
    (xii) Describe a suitable test for the strength of concrete.
    (xiii) State causes of segregation in a concrete mix.

15. EXCAVATE AND TIMBER TRENCHES
    (i) State methods of excavating trenches.
    (ii) Explain the term timber to trenches.
    (iii) State the purpose of timber to trenches.
    (iv) State the possible causes of collapse of the sides of excavation.
    (v) List the timber members which are used in planking and strutting to excavations.
    (vi) Outline the main points dealing with safety in the construction regulations regarding excavations.
    (vii) Sketch timbering for shallow and deep trench.

16. IDENTIFY MATERIALS FOR PAVING

(i) Describe a paving.
(ii) Specify standard width.
(iii) Select the materials for the construction of a paving.
(iv) Sketch the various types of paving.

17. TILE WALLS AND FLOORS

(i) List the methods which may be used for the fixing of tiles.
(ii) Describe the methods for fixing the tiles.
(iii) State the standard sizes of tiles.
(iv) Describe the method of cutting a tile in half.
(v) List the tools for scribing and cutting tiles.
(vi) Prepare wall and floors prior to tiling.
(vii) Grout the joints with coloured cement.
(viii) Use of patterns.

18. **DEMONSTRATE JOB ORGANIZATION**:

(i) Be safe.
(ii) Save effort.
(iii) Protect the materials.
(iv) Stack bricks and blocks safely within easy reach of the bricklayer.
(v) Space mortar boards at corners of building and not more than 3m apart along the wall length.
(vi) Level the ground off for easy walking and block up the mortar boards about 600mm from the face of the wall etc.

19. RECALL BRICKLAYING AND CONCRETING TERMS

(i) Describe terms related to bricklaying.
(ii) Describe terms related to concreting.

20. DEMONSTRATE WALL CONSTRUCTION

(i) Explain the term parapet wall.
(ii) Specify the thickness and height of a parapet wall.
(iii) Sketch parapet walls.
(iv) Explain the difference between a separating wall and a partition wall.
(v) Describe the method of cutting a hole for a 50mm diameter pipe in a partition wall.
(vi) Describe the methods of fixing a cantilever bracket in a partition built in bricks, etc.

21. IDENTIFY THE PURPOSE OF COPINGS

(i) Explain the term coping
(ii) State the purpose of a coping.
(iii) Describe the various types of copings.
(iv) Sketch the various types of copings.
(v) State the main factors concerning copings.
(vi) State the purpose of throating in a coping.
(vii) Explain how a throating works.

22. APPLY PLASTER TO WALLS

(i) Explain the terms plastering.
(ii) Describe render, float and set coats.
(iii) Know the reason for fixing of joinery work before the commencement of any plastering.
(iv) State reasons for plastering failure.

23. DESCRIBE LIME AND CEMENTS

(i) Explain the meaning of hydrated lime and hydraulic lime.
(ii) Describe the manufacture of building lime.
(iii) Describe the manufacture of cement.
(iv) Name the types of cements.
(v) Describe the types of cement and their uses.

24. DEFINE REINFORCED CONCRETE

(i) Explain the reason for placing and positioning steel rods in concrete.
(ii) Identify different sizes of steel rods.
(iii) State why the ends of the steel rods are hooked.
(iv) State why the steel should be cranked over the support.
(v) Explain why it is important to ensure that the steel rods are clean.

25. FIXING TIMBER FRAMES TO BRICK AND BLOCK WALLS

(i) Name the methods used to secure the frames.
(ii) Describe the various methods of fixing door frames to brick and block walls.
(iii) Sketch the various methods of fixing door frames etc.

26. **APPLY FLOOR FINISHES**:
    (i) Explain the term screed.
    (ii) Describe the monolithic method of laying screed on a concrete base.
    (iii) Describe the separate method of laying a screed on a concrete base.
    (iv) Explain why the mix for a floor screed for laying be not too wet.
    (v) Specify a suitable mix for a floor screed.
    (vi) Describe the method of setting battens before laying a screed.
    (vii) Illustrate the difference between basket weave and herring bones.
    (viii) Give a general description of the method of laying plastic, rubber or linoleum tiles.
    (ix) State why it is important to protect floor finished after they have been laid.
    (x) State the various methods that may be used to protect the floor finish.

CRAFT CALCULATIONS:- BLOCK LAYING, BRICKLAYING AND CONCRETING

1. **USE VULGAR AND DECIMAL FRACTIONS**:-
    (i) Find the denominator.
    (ii) Add, subtract, divide and multiply fractions.
    (iii) Change fractions to decimals.
    (iv) Convert decimals to fractions.
    (v) Simplify fractions.

2. **USE S.I. UNITS**:-
    (i) Explain S.I. units.
    (ii) State the advantages of S.I. units.
    (iii) Name the prefixes and their uses.
    (iv) Identify units of area and volume.
    (v) Recall the metric measures.
    (vi) Solve problems using the S.I. units

3. **CALCULATE AVERAGES, PERCENTAGES AND RATIOS**:-
    (i) Explain average, percentage and ratio.
    (ii) Solve problems involving average, percentage and ratio.
    (iii) Convert fraction to a percentage and percentage to a fraction etc.

4. **CALCULATE PERIMETERS AND AREAS OF PLANE FIGURES**:-
   (i) Explain and give example of perimeter.
   (ii) State S. I. units for perimeter and area.
   (iii) Deduce formula for perimeter and areas.
   (iv) Apply formula to calculate the perimeter and areas of plane figures.

5. **CALCULATE AREAS OF TRIANGLES**:-
   (i) Identify triangles.
   (ii) State the S.I. unit for the area.
   (iii) Apply the formula based on perpendicular heights to find the area.
   (iv) Apply the S.I formula to find the area when the triangle is not a right angle.

6. **CALCULATE VOLUME**:-
   (i) State the S.I unit for the volume.
   (ii) Multiply three linear dimensions to give the volume.
   (iii) Recall formula to fine the volumes of a prism, cylinder etc.
   (iv) Apply formula to find the volumes of excavation for foundation trenches.

7. **CALCULATE SQUARE AND SQUARE ROOTS**:-
   (i) Identify the square of a number.
   (ii) Determine the square root of a number by the method of factors.
   (iii) Use tales to find the square roots of a number etc.

8. **USE LOGARITHMS TO SOLVE PROBLEMS**:-
   (i) Explain the term index.
   (ii) Apply the laws of indices when multiplying and dividing.
   (iii) Name the parts of a logarithm.
   (iv) Use the tables of logarithms and antilogarithms.
   (v) Evaluate by using logarithms.

9. **APPLY PROPERTIES OF THE RIGHT-ANGLED TRIANGLE**:-
   (i) Identify a right-angled triangle.
   (ii) Sketch the right-angled triangle.
   (iii) State what is a right-angled triangle.
   (iv) Name the respective sides.
   (v) State the properties of the right-angled triangle.
   (vi) Solve problems using the theorem of Pythagoras.

10. **APPLY CIRCUMFERENCE AND AREA OF CIRCLE**:-
    (i) Explain the term circumference.
    (ii) Deduce formula for the circumference and areas of circle.
    (iii) Recall formula for circumference and areas of circle.
    (iv) Solve problems by using the formula.

11. **TRANSPOSE FORMULAE**:-
    (i) Describe a formula.
    (ii) Change the subjects of a formula.
    (iii) Construct a formula.
    (iv) Use formula to solve a problem.

12. **SOLVE SIMPLE EQUATIONS**:-
    (i) Explain the meaning of the term 'equation'.
    (ii) State the basic rule "Whatever we do to one side of an equation we must do to the other side".
    (iii) Solve simple equations by the systematic of the standard procedure.

13. **CALCULATE FOUNDATION SIZE**:-
    (i) Know the bearing capacity of the sub-soil.
    (ii) Know the total load of the wall or pier.
    (iii) Apply formula to find foundation area.

14. **CALCULATE EXTIMATES**:-
    (i) Apply the formula L x H x 14 x 59.25 to find the number of bricks.
    (ii) Recall that 1m of brick work requires 120 bricks.
    (iii) Explain the term yield.
    (iv) Recall that 1 m of day materials = 1/3 m of concrete.
    (v) Convert volumes to their equivalent weights.

CRAFT SCIENCE OF BLOCKLAYING AND BRICKLAYING AND CONCRETING

1. **OBSERVE EFFECTS OF WATER**:-
   (i) Explain the terms absorption, porosity, permeability and capillarity.
   (ii) Compare the rate of the water absorption of various building materials.
   (iii) Compare the passage of water (permeability) through various walls of the same thickness.
   (iv) Study the behaviour of water in narrow spaces.
   (v) Test the efficiency of a damp proof course.
   (vi) Study the effect of a throating.

2. **IDENTIFY PROPERTIES OF MATERIALS**:-
   (i) Define volume and density of a material.
   (ii) Calculate the density of a brick in g/dm3.
   (iii) Explain the specific gravity of a material.
   (iv) Calculate the percentage of voids in a sample of sand.
   (v) Describe how to find the solid density of a sample of sand.

3. **DEFINE EFFLORESCENCE**:-
   (i) Describe efflorescence.
   (ii) State causes of efflorescence.
   (iii) Show the action of efflorescence on bricks.
   (iv) State the effects of efflorescence.
   (v) Describe how bricks may be tested to discover whether they are likely to show efflorescence.

4. **DEFINE CONDENSATION**:-
   (i) State what is meant by condensation.
   (ii) Describe how it may be caused.
   (iii) Describe an experiment to show the effect of condensation on various surfaces.
   (iv) Give the cause of condensation.
   (v) Explain any difference in the effects on the surfaces.

5. **LOCATE METAL CORROSION**:-
   (i) Explain what corrosion of building materials is.
   (ii) State under what conditions is the rusting of iron most likely to take place.
   (iii) State the chemical name for iron rust.
   (iv) Describe the grading test for fine aggregate.
   (v) Describe ways in which the rusting of iron may be prevented.

6. **TEST AGGREGATES**:-
   (i) Explain the term aggregate.
   (ii) Classify aggregates.
   (iii) State the purpose of aggregate.
   (iv) Describe the grading test for fine aggregate.
   (v) Describe sand bulking.
   (vi) Calculate the percentage bulking of a sample of sand.

7. **TEST TEMPERATURE AND EXPANSION**:-
   (i) Explain what is meant by the temperature of a material.
   (ii) Name two common temperature scales in use.
   (iii) Draw two scales and the corresponding temperatures side by side.
   (iv) State the temperature of melting ice on Celsius scale, Kelvin scale Fahrenheit scale.
   (v) State the temperature of boiling water on each scale.
   (vi) Describe an experiment to compare the Celsius and Fahrenheit scales.
   (vii) Convert C to K to C.
   (viii) Explain what is meant by the expansion and constriction of a material.
   (ix) Describe an experiment to show that a metal expands when heated and contract when cool.

8. **DEMONSTRATE TRANSFER OF HEAT**:-

(i) Explain what is meant by conduction of heat.
(ii) List five good insulators of heat.
(iii) Describe how convection may be demonstrated and sketch the apparatus used.
(iv) State two ways in which heat may be transferred.
(v) Explain the following terms in relation to heat convection and radiation.

9. **DESCRIBE LIFTING TACKLE**:-

(i) Give reasons why a single pulley is used on a building site.
(ii) Sketch a simple hoist including a system of two pulleys.
(iii) Determine velocity ratio, mechanical advantage and efficiency.

10 **DEMONSTRATE MECHANICS OF BEAM**:-

(i) Define force.
(ii) State the unit for force.
(iii) Explain the terms tension, compression and shear.
(iv) Explain the term resultant applied to a system of forces.
(v) Calculate the resultant of forces arithmetically and graphically.
(vi) Calculate moments of force.
(vii) Determine the magnitude of the support reactions for simply supported beam.

A COURSE OUTLINE

FOR

TECHNICAL INSTITUTES

MINISTRY OF EDUCATION AND CULTURAL DEVELOPMENT

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