**SAMPLE PAPERS**

**DIPLOMA FIFTH SEMESTER EXAMINATION 2025 ( JUT)**

**GEO TECHNICAL ENGINEERING**

*DIPLOMA WALLAH*

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Full Marks: 70 marks | Time: 3 Hours

**Instructions:**

- Question No. 1 is compulsory.
- Answer any **FOUR** questions from the remaining (Q.2 to Q. 7 marks ).

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**Q.1 Multiple Choice Questions (Compulsory)**

*(Attempt all questions. Each carries 2 marks.)*

(i) Which of the following is an example of a Metamorphic Rock?

(a) Granite

(b) Marble

(c) Sandstone

(d) Basalt

(ii) A soil sample is fully saturated. Its Degree of Saturation (S) is:

(a) 0%

(b) 50%

(c) 100%

(d) > 100%

(iii) Pycnometer is used to determine which property of soil?

(a) Water Content and Specific Gravity

(b) Permeability

(c) Shear Strength

(d) Consolidation

(iv) Darcy's Law is valid only when the flow of water through soil is:

(a) Turbulent

(b) Laminar

(c) Transient

(d) Rotational

(v) Sheep-foot rollers are most suitable for compacting:

(a) Gravels

(b) Sands

(c) Clayey soils

(d) Crushed Rock

(vi) The value of the Uniformity Coefficient ( $C_u$ ) for well-graded sand must be greater than:

(a) 1

(b) 3

(c) 4

(d) 6

(vii) In the Standard Penetration Test (SPT), the weight of the hammer used is:

(a) 45 kg

(b) 63.5 kg

(c) 75 kg

(d) 80 kg

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Q.2

(A) Explain the Three-Phase System of soil with a neat sketch. Derive the relationship between Void Ratio ( e ), Porosity ( n ), and Degree of Saturation ( S ). (7 Marks)

(B) Explain the procedure to determine the dry density of soil in the field by the Core Cutter Method. Draw a neat diagram. (7 Marks)

Q.3

(A) State Darcy's Law of permeability. Explain the laboratory procedure to determine the coefficient of permeability by the Constant Head Method. (7 Marks)

(B) Define Consolidation. Differentiate between Compaction and Consolidation. (7 Marks)

Q.4

(A) Explain Mohr-Coulomb's Law of shear strength. Draw the strength envelope for: (i) Purely cohesive soil, (ii) Purely frictional soil, and (iii) c-$\varphi$ soil. (7 Marks)

(B) Explain the Standard Proctor Test to determine OMC and MDD with a neat sketch of the compaction curve. (7 Marks)

Q.5

(A) Describe the procedure of the Plate Load Test for determining the bearing capacity of soil. What are its limitations? (7 Marks)

(B) Define Earth Pressure. Explain Active Earth Pressure, Passive Earth Pressure, and Earth Pressure at Rest. (7 Marks)

Q.6

(A) Explain the procedure of the Direct Shear Test with a neat diagram. (7 Marks)

(B) Define the following terms: (7 Marks)

1. Water Content
2. Void Ratio
3. Degree of Saturation
4. Specific Gravity

Q.7 Write Short Notes on (Any FOUR): (4 × 3.5 = 14 Marks)

(A) Liquid Limit and Plastic Limit

(B) Uses of Flow Net

(C) Soil Stabilization

(D) General Shear Failure

(E) Igneous Rocks

## SOLUTIONS & KEY (PAPER 1)

MCQ Answer Key:

(i) b (Marble)

(ii) c (100%)

(iii) a (Water Content & Specific Gravity)

(iv) b (Laminar)

(v) c (Clayey soils)

(vi) d (6)

(vii) b (63.5 kg)

**Model Hints for Long Questions:**

- **Q2(A):** Draw block diagram (Solids, Water, Air). Use Se = wG or n = e/(1+e) derivations.
- **Q2(B):** Mention apparatus (Cutter, Dolly, Rammer). Step-by-step: Weight of cutter -> Field extraction -> Weighing soil -> Calculation.
- **Q4(A):** Equation: tau = c + $\sigma$ tan $\varphi$ . Draw 3 graphs.
- **Q5(A):** Focus on the setup: Test pit size, Loading truss, Jack, Dial gauges, Load-Settlement curve.

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