

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S4 (R) (FT/WP) Examinations April 2026 (2024 Scheme)



Course Code: PCET402

Course Name: SOIL MECHANICS

Max. Marks: 60

Duration: 2 hours 30 minutes

Students are permitted to bring IS1498 and IS 2720 (all relevant parts)

PART A

(Answer all questions. Each question carries 3 marks)

		CO	Marks
1	Derive a relationship between Porosity and Void ratio.	1	(3)
2	In a field density test using core cutter method the mass of core cutter is 1.25 kg, inside diameter is 100 mm, height is 127.33 mm. the mass of soil with core cutter is 3.25 kg. find the field mass density? If the water content is 20 % what will be the dry density.	1	(3)
3	Define Liquidity Index, Consistency Index and Flow Index.	2	(3)
4	List the factors affecting permeability.	1	(3)
5	A square area of 1.5 m × 1.5 m at the ground surface carries a uniformly distributed load of 200 kN/m ² . Determine the increase in vertical pressure at a depth of 2 m directly below the center of the loaded area using the approximate 2:1 stress distribution method.	3	(3)
6	Draw a sample compaction curve and explain Optimum Moisture Content and Maximum Dry Density.	4	(3)
7	List out the assumptions of Terzaghi's theory of one -dimensional consolidation.	4	(3)
8	State Mohr–Coulomb failure criterion and write its mathematical expression	4	(3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module -1

- 9 a) The specific gravity of a soil is 2.7, void ratio is 0.7, degree of saturation is 80%. What will be the field water content, bulk unit weight, saturated unit weight, dry unit weight, and submerged unit weight of the soil. 1 (5)
- b) Draw the three-phase block diagram and derive the relationship between Void Ratio, Specific Gravity, Water Content and Degree of Saturation. 1 (4)
- 10 a) In a field density test using the sand replacement method, the following observations were made: 1 (6)
- Calibration stage
 Weight of cylinder + sand before pouring to calibration cylinder = 6.50 kg
 Weight of cylinder + sand after pouring to calibration cylinder = 4.10 kg
 Weight of cylinder + sand before pouring to plane glass sheet = 6.55 kg
 Weight of cylinder + sand after pouring to glass sheet = 6.15 kg
 Volume of calibration cylinder = 1250 cm³
- Field test stage
 Weight of sand pouring cylinder + sand before pouring = 6.50 kg
 Weight of sand pouring cylinder + sand after pouring = 4.20 kg
 Weight of wet soil excavated from the hole = 2.375 kg
 Water content of the soil = 10%
 Find the Bulk density, Dry density, and Dry unit weight of the soil.
- b) Draw neat schematic diagrams showing the basic structural units of Montmorillonite, Illite, and Kaolinite. 1 (3)

Module -2

- 11 a) A constant head permeability test was carried out on a cylindrical shape of sand 10.2 cm diameter and 14cm height, 10cm³ of water was collected in 17 minutes under a head of 125 cm. If the same test was conducted using falling head test how much time it will take the head to fall from 125 cm to 75 cm through a stand pipe of diameter 1 cm. 4 (6)
- b) If the liquid limit, plastic limit and shrinkage limit of a soil are 50%, 20% and 12% respectively, as per IS classification what is the type of soil. The percentage finer 2 (3)

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corresponding to 75 micron sieve is 90 %.

- 12 a) The result of a sieve analysis is given. Draw the particle size distribution curve. Find Effective size, Uniformity coefficient and coefficient of curvature. Also write the classification of the soil. 2 (6)

Sieve size (mm)	4.75	2.36	1.18	0.6	0.425	0.3	0.15	0.075	PAN
Wt. retained (grams)	20	60	60	60	75	75	50	50	50

- b) List any three corrections in hydrometer method used in particle size analysis. Mention the nature of correction also 2 (3)

Module -3

- 13 a) A water tank is supported on a circular ring type of foundation. The ring is 1.5m wide and its external diameter is 8m. Compute the vertical stress at 1.5m depth beneath the centre of foundation, if pressure on the foundation is 150kPa. 3 (5)

- b) Explain Quick sand condition the term critical hydraulic gradient. 3 (4)

- 14 a) A soil profile consists of: 3 (9)

A top layer of sand 2 m thick with bulk unit weight 16 kN/m^3 and saturated unit weight 18 kN/m^3

An intermediate layer of dense sand 3 m thick with saturated unit weight 19 kN/m^3

A bottom layer of sand 4 m thick with saturated unit weight 20 kN/m^3

The water table is located at 2 m below ground level. Due to capillary action, the saturated zone above the water table extends 1 m above it.

A surcharge load of 20 kN/m^2 is applied on the ground.

Using this information:

Determine the total stress (σ), neutral stress (pore water pressure, u), and effective stress (σ')

Plot the variation of total stress, neutral stress, and effective stress with depth through the soil profile.

Module -4

- 15 a) A series of direct shear tests was conducted on soil, each test was carried out till the specimen failed. The following results were obtained. 4 (6)

Sample No.	Normal stress (kN/m ²)	Shear Stress (kN/m ²)
1	15	18
2	30	25
3	45	32

Determine the cohesion intercept and the angle of shearing resistance.

- b) List three differences between compaction and consolidation. 4 (3)
- 16 a) A soil sample of thickness 2 cm was tested in an oedometer, and the time required for 50% consolidation was found to be 1.5 hours. Determine the time required for 50% and 90% consolidation for the same soil in the field, where the layer thickness is 5 m. Assume double drainage in both cases. 4 (6)
- b) Neatly sketch the shape of an e-log p curve and mark the salient features after drawing the loading and reloading curves too in it. 4 (3)

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