

# GATE 2024 CE1 Question Paper (Memory-Based)

- An embankment is constructed with soil by maintaining the degree of saturation as 75% during compaction. The specific gravity of soil is 2.68 and the moisture content is 17% during compaction. Consider the unit weight of water as  $10 \text{ kN/m}^3$ . The dry unit weight (in  $\text{kN/m}^3$ ) of the compacted soil is \_\_\_\_\_ (rounded off to 2 decimal places).
- A car is travelling at a speed of  $60 \text{ km/hr}$  on a section of a National Highway having downward gradient of 2%. The driver of the car suddenly observes a stopped vehicle on the car path at a distance  $130\text{m}$  ahead, and applies brakes. If the brake efficiency is 60%, coefficient of friction is 0.7, driver's reaction time is 2.5 s and acceleration due to gravity is  $9.81 \text{ m/s}^2$ , the distance (in meters) required by the driver to bring the car to a safe stop lies in the range.
  - (a) 75 to 79
  - (b) 33 to 37
  - (c) 126 to 130
  - (d) 41 to 45
- The number of degrees of freedom for a natural open channel flow with a mobile bed is
  - (a) 2
  - (b) 5
  - (c) 3
  - (d) 4
- Among the following statements relating the fundamental lines of transit theodolite, which one is CORRECT?
  - (a) The axis of altitude level must be perpendicular to the line of collimation.
  - (b) The line of collimation must be perpendicular to the horizontal axis at its intersection with the vertical axis.
  - (c) The axis of plate level must lie in a plane parallel to the vertical axis.
  - (d) The Vernier of vertical circle must read zero when the line of collimation is vertical.
- The elements that DO NOT increase the strength of structural steel are
  - (a) Manganese
  - (b) Carbon
  - (c) Chlorine
  - (d) Sulphur
- Consider a balanced doubly-reinforced concrete section. If the material and other sectional properties remain unchanged, for which of the following cases will the section become under-reinforced?
  - (a) Increase the area of compression reinforcement
  - (b) Decrease the area of tension reinforcement

- (c) Decrease the area of compression reinforcement
- (d) Increase the area of tension reinforcement

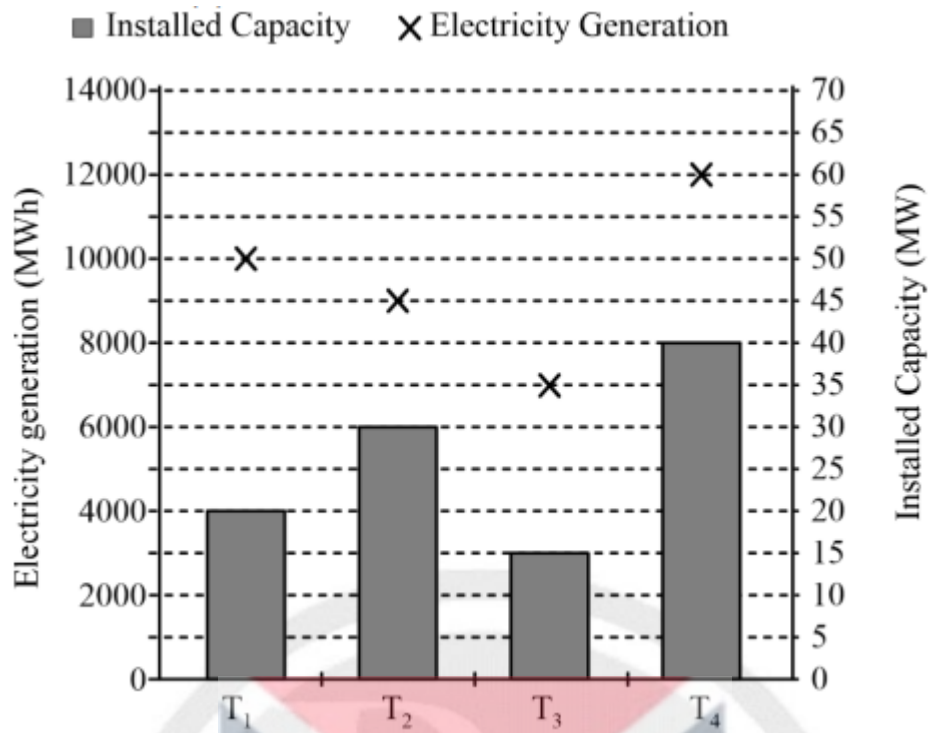
- If the number of sides resulting in a closed traverse is increased from three to four, the sum of the interior angles increases by
  - (a)  $180^\circ$
  - (b)  $360^\circ$
  - (c)  $90^\circ$
  - (d)  $270^\circ$
- A 30 cm diameter well fully penetrates an unconfined aquifer of saturated thickness 20 m with hydraulic conductivity of 10 m/day. Under the steady pumping rate for a long time, the drawdowns in two observation wells located at 10 m and 100 m from the pumping well are 5 m and 1 m respectively. The corresponding pumping rate (in  $\text{m}^3/\text{day}$ ) from the well is \_\_\_\_\_ .

- Consider the data of  $f(x)$  given in the table:

i	0	1	2
$x_i$	1	2	3
$f(x_i)$	0	0.3010	0.4771

The value of  $f(1.5)$  estimated using second-order Newton's interpolation formula is \_\_\_\_\_ (rounded off to 2 decimal places).

- A surveyor observes a zenith angle of  $93^\circ 00' 00''$  during a theodolite survey. The corresponding vertical angle is (a)  $- 03^\circ 00' 00''$  (b)  $+ 03^\circ 00' 00''$  (c)  $+ 87^\circ 00' 00''$  (d)  $- 87^\circ 00' 00''$
- An infinite slope is made up of cohesionless soil with seepage parallel to and up to the sloping surface. The angle of slope is 30 degrees with respect to the horizontal ground surface. The unit weight of the saturated soil and water are  $20 \text{ kN/m}^3$  and  $10 \text{ kN/m}^3$ , respectively. The minimum angle of shearing resistance of the soil (in degrees) for the critically stable condition of the slope is \_\_\_\_\_ (rounded off to the nearest integer).
- The chart given below compares the Installed Capacity (MW) of four power generation technologies. T1, T2, T3 and T4 and their Electricity Generation (MWh) in a time of 1000 hours (h).



The Capacity Factor of a power generation technology is:

$$\text{Capacity Factor} = \frac{\text{Electricity Generation (MWh)}}{\text{Installed Capacity (MW)} \times 100(\text{h})}$$

Which one of the given technologies has the highest Capacity Factor?

- (a) T<sub>2</sub>
  - (b) T<sub>4</sub>
  - (c) T<sub>1</sub>
  - (d) T<sub>3</sub>
- On a given day how many times will the second hand the minute hand of a clock cross each other during the clock time 12:05:00 hours to 12:55:00 hours
    - (a) 51
    - (b) 49
    - (c) 55
    - (d) 50
  - For positive integers P and q with

$$\frac{P}{q} \neq 1, \left(\frac{p}{q}\right)^{\frac{p}{q}} = p^{\left(\frac{p-1}{q}\right)},$$

, then:

(a)  $q^p = p^{2q}$

(b)  $q^p = p^q$

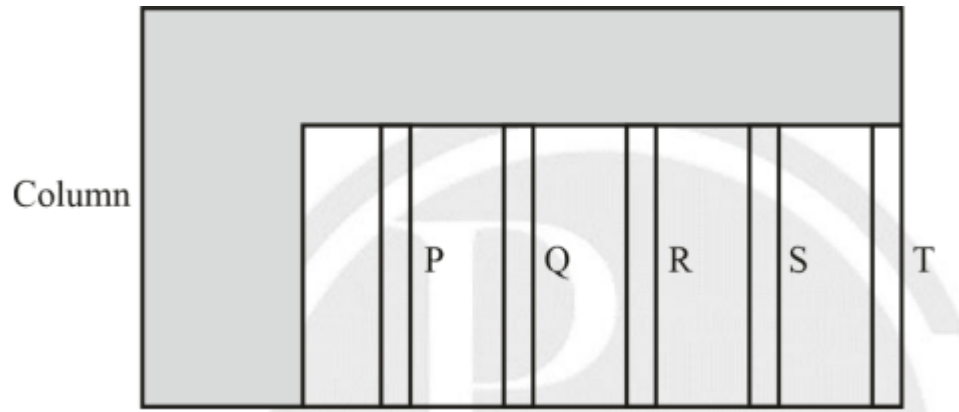
(c)  $\sqrt{q} = \sqrt{p}$

(d)  $\sqrt[p]{q} = \sqrt[q]{p}$

- In a locality the houses are numbered in the following way: The hours number on one side of a road are consecutive odd integers starting from 301 while the hours numbers on the side of the road are consecutive even numbers starting from 302. The total number of houses is the same on both sides of the road. If the difference of the sum of the hours numbers between the two sides of road is 27, then the number of houses on each of the road is
  - (a) 52
  - (b) 27
  - (c) 26
  - (d) 54
- For assessing the compliance with the emissions standards of incineration plants a correction needs to be applied to the measured concentrations of air pollutants. The emission standard (based on 11% Oxygen) for HCl is 50 mg/Nm<sup>3</sup> and the measured concentrations of HCl and Oxygen in the flue gas are 42 mg/Nm<sup>3</sup> and 13% respectively. Assuming 21% Oxygen in air the CORRECT statement is:
  - (a) No compliance as the corrected HCl emission is greater than the emission standard
  - (b) Compliance as there is no need to apply the correction since Oxygen is greater than 11% and HCl emission is less than the emission standard.
  - (c) No compliance as the Oxygen is greater than 11% in the flue gas
  - (d) Compliance is there as the corrected A slab panel with an effective depth of 250 mm is reinforced with 0.2% main reinforcement using 8mm diameter steel bars. The uniform center to center spacing (in mm) at which the 8 mm diameter bars are placed in the slab panel is \_\_\_\_\_ (rounded off to the nearest integer)emission is lesser than the emission standard
- Activated carbon is used to remove a pollutant from wastewater in a mixed reactor, which follows first order reaction kinetics At a reaction rate of 0.38 / day the time (in day) required to remove the by 95% is \_\_\_\_\_ (rounded off to 1 decimal place)
- A slab panel with an effective depth of 250 mm is reinforced with 0.2% main reinforcement using 8mm diameter steel bars. The uniform centre to centre spacing (in mm) at which the 8 mm diameter bars are placed in the slab panel is \_\_\_\_\_ (rounded off to the nearest integer)
- A soil sample was consolidated at a cell pressure of 20 kPa and a back pressure of 10 kPa for 24 hours during a consolidated undrained (CU) triaxial test. The cell pressure was increased to 30 kPa on the next day and it resulted in the development of pore water pressure of 1 kPa. The soil sample failed when the axial stress was gradually increased to 50 kPa. The pore water pressure at failure was recorded as 21 kPa. The value of Skempton's pore pressure parameter B for The soil sample is

\_\_\_\_\_ (rounded off 2 decimal places)

- A map is prepared with a scale of 1: 1000 and a contour interval of 1 m. If the distance between two adjacent contour on the map is 10 mm. the slope of the ground between the adjacent contours is
  - (a) 35%
  - (b) 30 %
  - (c) 10%
  - (d) 40%
- A spillway has unit discharge of  $7.5 \text{ m}^3 / \text{s/m}$ . The flow depth at the downstream horizontal apron is m. The tail water depth (in meters) required to from a hydraulic jump is \_\_\_\_\_(rounded off to 2 decimal places)
- The following data is obtained from an axle load survey at a site: Average rear axle load = 12000 kg Number of commercial vehicles = 800 per day The pavement at the site would be reconstructed over a period of 5 years from the date of survey, The design life of the reconstructed pavement is 15 year. Use the standard axle load as 8160 kg and the annual average vehicle growth rate as 4.0% Assume that Equivalent Wheel Load Factor (EWLF) and Vehicle Damage Factor (VDF) are equal. The cumulative standard axle (in msa) for the pavement design is \_\_\_\_\_ (rounded off to 2 decimal places)
- Concrete of characteristic strength 30 MPa is required. If 40 specimens of concrete cubes are to be tested, the minimum number of specimens having at least 30 MPa strength should be:
  - (a) 38
  - (b) 39
  - (c) 35
  - (d) 37
- The free mean speed is 60 km/hr on a given road. The average space headway at jam density on the road is 8 m. For a linear speed density relationship the maximum flow (in veh/hr/lane) expected on the road is
- Runway length of airport increases by x% for every increase in height of y m. The values of x and y are respectively (a) x is 10% and y is 200 m (b) x is 7% and y is 300 m (c) x is 20% and y is 400 m (d) x is 10% and y is 200 m.
- Given below is a cantilever beam, supported on props P, Q, R, S, T during casting



The order in which props PQRST will be removed

- (a) T-S-R-Q-P
- (b) P-Q-R-S-T
- (c) P-S-R-Q-T
- (d) R-Q-T-P-S

