

TS PGECET 2025 Question Paper With Solutions

Time Allowed :2 Hours	Maximum Marks :120	Total questions :120
------------------------------	---------------------------	-----------------------------

General Instructions

Read the following instructions very carefully and strictly follow them:

1. **Mode of Examination:** Online (Computer-based examination)
2. **Medium of Exam:** English
3. **Duration of Exam:** 2 hours
4. **Type of Questions:** Multiple-choice questions
5. **Number of Questions:** 120 Questions
6. **Total Marks:** 120 Marks
7. **Marking Scheme:**
 - 1 mark for each correct answer.
 - No negative markings for incorrect answers.

1. Find the eigenvalues of the matrix:

$$A = \begin{pmatrix} 4 & 1 \\ 2 & 3 \end{pmatrix}$$

(1) 3, 4

(2) 5, 2

(3) 4, 1

(4) 6, 1

Correct Answer: (1) 3, 4

Solution: To find the eigenvalues, we solve the characteristic equation:

$$\begin{aligned} \det(A - \lambda I) &= 0 \\ \det \begin{pmatrix} 4 - \lambda & 1 \\ 2 & 3 - \lambda \end{pmatrix} &= 0 \\ (4 - \lambda)(3 - \lambda) - 2 &= 0 \\ \lambda^2 - 7\lambda + 10 &= 0 \\ \lambda &= 3, 4 \end{aligned}$$

Quick Tip

For 2x2 matrices, the eigenvalues can be calculated by solving the characteristic equation $\det(A - \lambda I) = 0$.

2. Evaluate the integral:

$$\int_0^{\pi} \sin^2(x) dx$$

(1) $\frac{\pi}{2}$

(2) $\frac{\pi}{4}$

(3) π

(4) 1

Correct Answer: (1) $\frac{\pi}{2}$

Solution: Use the identity $\sin^2(x) = \frac{1 - \cos(2x)}{2}$:

$$\int_0^{\pi} \sin^2(x) dx = \int_0^{\pi} \frac{1 - \cos(2x)}{2} dx$$

$$\begin{aligned}
&= \frac{1}{2} \int_0^\pi 1 \, dx - \frac{1}{2} \int_0^\pi \cos(2x) \, dx \\
&= \frac{1}{2} [x]_0^\pi - \frac{1}{4} [\sin(2x)]_0^\pi \\
&= \frac{\pi}{2} - 0 = \frac{\pi}{2}
\end{aligned}$$

Quick Tip

Use trigonometric identities to simplify integrals involving squared trigonometric functions.

3. Solve the differential equation:

$$\frac{d^2y}{dx^2} + 4y = 0$$

(1) $y = C_1 \cos(2x) + C_2 \sin(2x)$

(2) $y = C_1 e^{2x} + C_2 e^{-2x}$

(3) $y = C_1 e^x + C_2 e^{-x}$

(4) $y = C_1 \cos(x) + C_2 \sin(x)$

Correct Answer: (1) $y = C_1 \cos(2x) + C_2 \sin(2x)$

Solution: The characteristic equation is:

$$r^2 + 4 = 0$$

$$r = \pm 2i$$

Thus, the general solution is:

$$y = C_1 \cos(2x) + C_2 \sin(2x)$$

Quick Tip

For second-order linear differential equations with constant coefficients, solve the characteristic equation to find the general solution.

4. If a die is rolled twice, what is the probability that the sum of the numbers is 7?

(1) $\frac{1}{6}$

(2) $\frac{1}{12}$

(3) $\frac{1}{36}$

(4) $\frac{5}{36}$

Correct Answer: (4) $\frac{5}{36}$

Solution: The possible outcomes for a sum of 7 are: (1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1).

There are 6 favorable outcomes. The total number of outcomes when rolling two dice is $6 \times 6 = 36$. Thus, the probability is:

$$P(\text{sum} = 7) = \frac{6}{36} = \frac{1}{6}$$

Quick Tip

For rolling two dice, use the total number of outcomes and favorable outcomes to find probabilities.

5. Which data structure is used in the implementation of recursion?

(A) Stack

(B) Queue

(C) Linked List

(D) Array

Correct Answer: (A) Stack

Solution: Recursion is implemented using the call stack in memory. When a function is called, its execution is pushed onto the stack, and when it returns, it is popped off the stack. Thus, the stack data structure is used.

Quick Tip

When using recursion, the call stack keeps track of the function calls and their return values.

6. In a series RLC circuit, if the resistance is 10, inductance is 0.1H, and capacitance is 100F, calculate the resonant frequency.

(1) 500 Hz

(2) 1000 Hz

(3) 1590 Hz

(4) 300 Hz

Correct Answer: (1) 500 Hz

Solution: The resonant frequency f_r for a series RLC circuit is given by:

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

Substituting the values:

$$f_r = \frac{1}{2\pi\sqrt{0.1 \times 100 \times 10^{-6}}} = 500 \text{ Hz}$$

Quick Tip

For RLC circuits, use the formula $\frac{1}{2\pi\sqrt{LC}}$ to calculate the resonant frequency.

7. Determine the moment of inertia of a rectangular beam section with a width of 300 mm and height of 500 mm about its neutral axis.

(1) $1.25 \times 10^7 \text{ mm}^4$

(2) $2.5 \times 10^7 \text{ mm}^4$

(3) $3.75 \times 10^7 \text{ mm}^4$

(4) $4.5 \times 10^7 \text{ mm}^4$

Correct Answer: (1) $1.25 \times 10^7 \text{ mm}^4$

Solution: The moment of inertia I for a rectangle about its neutral axis is given by:

$$I = \frac{1}{12}bh^3$$

Substituting the values:

$$I = \frac{1}{12} \times 300 \times (500)^3 = 1.25 \times 10^7 \text{ mm}^4$$

Quick Tip

The formula for the moment of inertia of a rectangle is $\frac{1}{12}bh^3$ where b is the base and h is the height.

8. Calculate the efficiency of a Carnot engine operating between temperatures of 500K and 300K.

- (1) 40%
- (2) 60%
- (3) 70%
- (4) 50%

Correct Answer: (1) 40

Solution: The efficiency of a Carnot engine is given by:

$$\eta = 1 - \frac{T_C}{T_H}$$

Substituting the values:

$$\eta = 1 - \frac{300}{500} = 0.4 = 40\%$$

Quick Tip

For a Carnot engine, efficiency is calculated using the temperatures of the hot and cold reservoirs.

9. What is the Reynolds number for flow in a pipe with a diameter of 0.05 m, velocity of 2 m/s, and kinematic viscosity of $1 \times 10^{-6} \text{ m}^2/\text{s}$?

- (1) 1000
- (2) 2000
- (3) 4000
- (4) 5000

Correct Answer: (1) 1000

Solution: Reynolds number is given by:

$$Re = \frac{VD}{\nu}$$

Substituting the values:

$$Re = \frac{2 \times 0.05}{1 \times 10^{-6}} = 1000$$

Quick Tip

Reynolds number is a dimensionless number used to predict flow patterns in different fluid flow situations.

10. Which of the following is a beta-blocker used in the treatment of hypertension?

- (A) Metoprolol
- (B) Amlodipine
- (C) Losartan
- (D) Enalapril

Correct Answer: (A) Metoprolol

Solution: Metoprolol is a beta-blocker commonly prescribed to treat hypertension and other heart-related conditions.

Quick Tip

Beta-blockers such as Metoprolol work by blocking the effects of adrenaline on the heart, reducing heart rate and blood pressure.
