



रोल नं.

Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें।

Candidates must write the Q.P. Code on the title page of the answer-book.

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 7 हैं।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में 14 प्रश्न हैं।
- कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें।
- इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है। प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा। 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे।
- Please check that this question paper contains 7 printed pages.
- Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains 14 questions.
- Please write down the Serial Number of the question in the answer-book before attempting it.
- 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.



गणित

MATHEMATICS



निर्धारित समय : 2 घण्टे

Time allowed : 2 hours

अधिकतम अंक : 40

Maximum Marks : 40



General Instructions :

Read the following instructions very carefully and strictly follow them :

1. This question paper contains **three** Sections- **A, B and C**.
2. **Each** section is compulsory.
3. **Section-A** has 6 short-answer type-I questions of 2 marks each.
4. **Section-B** has 4 short-answer type-II questions of 3 marks each.
5. **Section-C** has 4 long-answer type questions of 4 marks each.
6. There is an internal choice in some questions.
7. Question 14 is a case study based question with **two** subparts of 2 marks each.

SECTION A

Question numbers 1 to 6 carry 2 marks each.

1. The Cartesian equation of a line AB is : 2

$$\frac{2x-1}{12} = \frac{y+2}{2} = \frac{z-3}{3}$$

Find the direction cosines of a line parallel to line AB.

2. Find : $\int \frac{dx}{\sqrt{4x-x^2}}$ 2

3. (a) Events A and B are such that 2

$$P(A) = \frac{1}{2}, P(B) = \frac{7}{12} \text{ and } P(\overline{A} \cup \overline{B}) = \frac{1}{4}$$

Find whether the events A and B are independent or not.

OR

- (b) A box B_1 contains 1 white ball and 3 red balls. Another box B_2 contains 2 white balls and 3 red balls. If one ball is drawn at random from each of the boxes B_1 and B_2 , then find the probability that the two balls drawn are of the same colour. 2

4. Find the general solution of the following differential equation : 2

$$\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$$



5. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{a} \cdot \vec{b} = 1$ and $\vec{a} \times \vec{b} = \hat{j} - \hat{k}$, then find $|\vec{b}|$ 2

6. Let X be a random variable which assumes values x_1, x_2, x_3, x_4 such that $2P(X = x_1) = 3P(X = x_2) = P(X = x_3) = 5P(X = x_4)$. Find the probability distribution of X . 2

SECTION B

Question numbers 7 to 10 carry 3 marks each.

7. (a) If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a} + \vec{b}| = |\vec{b}|$, then prove that $\left(\vec{a} + 2\vec{b}\right)$ is perpendicular to $\vec{a}$. 3

OR

(b) If $\vec{a}$ and $\vec{b}$ are unit vectors and θ is the angle between them, then prove that $\sin \frac{\theta}{2} = \frac{1}{2} |\vec{a} - \vec{b}|$. 3

8. (a) Find : $\int e^x \cdot \sin 2x \, dx$ 3

OR

(b) Find : $\int \frac{2x}{(x^2+1)(x^2+2)} \, dx$ 3

9. Evaluate : $\int_1^3 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{4-x}} \, dx$ 3

10. Find the distance of the point $(2, 3, 4)$ measured along the line $\frac{x-4}{3} = \frac{y+5}{6} = \frac{z+1}{2}$ from the plane $3x+2y+2z+5 = 0$. 3



SECTION C

Question numbers 11 to 14 carry 4 marks each.

11. Find the area bounded by the curves $y = |x-1|$ and $y = 1$, using integration. 4

12. (a) Solve the following differential equation : 4

$$(y - \sin^2 x)dx + \tan x dy = 0$$

OR

- (b) Find the general solution of the differential equation : 4

$$(x^3 + y^3)dy = x^2 y dx$$

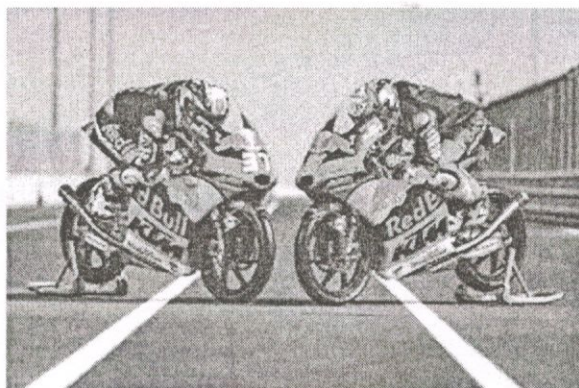
13. There are two boxes, namely box-I and box-II. Box-I contains 3 red and 6 black balls. Box-II contains 5 red and 5 black balls. One of the two boxes, is selected at random and a ball is drawn at random. The ball drawn is found to be red. Find the probability that this red ball comes out from box-II. 4

Case Study Based Question

14. Two motorcycles A and B are running at the speed more than the allowed speed $2 \times 2 = 4$

on the roads represented by the lines $\vec{r} = \lambda(\hat{i} + 2\hat{j} - \hat{k})$ and

$\vec{r} = (3\hat{i} + 3\hat{j}) + \mu(2\hat{i} + \hat{j} + \hat{k})$ respectively.



Based on the above information, answer the following questions :

- (a) Find the shortest distance between the given lines. 2
- (b) Find the point at which the motorcycles may collide. 2