MATHEMATICS 2005 Compartment (Outside Delhi)

General Instructions:

The question paper consists of three Sections A, B and C. Section. In addition to Section as, every student has to attempt either Section B or Section C.

1. For Section A

   Question numbers **1** to **8** are of **3** marks each.

   Question numbers **9** to **15** are of **4** marks each.

   Question numbers **16** to **18** are of **6** marks each.

2. For Section B/Section C

   Question numbers **19** to **22** are of **3** marks each.

   Question numbers **23** to **25** are of **4** marks each.

   Question numbers **26** is of **6** marks.

3. All questions are compulsory.

4. Internal choices have been provided in some questions. You have to attempt only one of the choices in such questions.

5. Use of calculator is not permitted. However, you may ask for logarithmic and statistical tables, if required.

SECTION – A

Q1. Using properties of determinants, show that

$$\begin{vmatrix} 1 & a & a^2 - bc \\ 1 & b & b^2 - ca \\ 1 & c & c^2 - ab \end{vmatrix} = 0$$

Q5. Evaluate: $\int \dfrac{1}{5\cos x - 12\sin x}dx$

Q10. If $y = x^x$, show that

$$\dfrac{d^2y}{dx^2} - \dfrac{1}{y}\left(\dfrac{dy}{dx}\right)^2 - \dfrac{y}{x} = 0$$

Q13. Using differentials, find the approximate value of $\sqrt{0.037}$.

Q18. Using integration, find the region in the first quadrant enclosed by the x-axis, the line $x = \sqrt{3}y$ and the circle $x^2 + y^2 = 4$.

SECTION- B

Q19. If $\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k}$, and $\vec{b} = 3\hat{i} - \hat{j} - \hat{k}$ and $\vec{c} = \hat{i} + 2\hat{j} - 3\hat{k}$, then verify that $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$.

Q22. A particle just clears wall of height 'b' at a distance 'a' and strikes the ground at a distance 'c' from the point of projection. Prove that the angle of projection is $\tan^{-1}\left[\dfrac{bc}{a(c-a)}\right]$ and the velocity of projection u is given by $\dfrac{2u^2}{g} = \dfrac{a^2(c-a)^2 + b^2c^2}{ab(c-a)}$.

Q24. Two forces of magnitude $P+Q$ and $P-Q$ make an angle 2α with one another, and their resultant makes an angle θ with the bisector of the angle between them. Show that $P\tan\theta = Q\tan\alpha$.

SECTION - C

Q21. Two cards are drawn successively with replacement from a well- shuffled pack of 52 cards. Find the mean and variance for the number of aces.

Or

There are 5% defective bulbs of bulbs. What is the probability that a sample of 10 bulbs. Will includes not more than 1 defective bulb? (Use e -0.5 = 0.6065)

Q22. Two bags A and B contain 2 white, 4 red; and 3 white, 3 red balls respectively. One of the bags is selected at random and a ball is drawn from it. If the selected ball is of white colour, find the probability that it is drawn from bag A.

Q25. A and B are partners sharing profit and losses in the ratio 1 : 2 respectively. They admit C as a new partner, the new profit sharing ratio being 1 : 2 : 2 between A, B and C, respectively. C pays Rs.12,000 as premium for goodwill. How will the premium be shared between A and B?