Sub.Code : 216 Old

NEB - GRADE XII

Mathematics

(Old Course)

It is for those students whose first two digit of registration number starts from 56 to 67 .

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks.

Full Marks -100

Time -3.00 hrs. **Pass Marks - 35**

Group 'A' $6 \times 3 \times 2 = 36$

Attempt all questions:

1. a. If $a^x = b^y = c^z$ and a, b, c are in G.P. Then prove that x, y, z are in H.P.
   b. Prove that the sum of the binomial coefficients in the expansion of $(1+x)^n$ is 2^n.
   c. Distinguish between permutation and combination with examples.
2. a. Find the length of the tangent drawn from the point (11,3) to the circle $x^2 + y^2 = 65$.
   b. Find the equation of the parabola whose vertex is (0,0) and focus is (0,4).
   c. Find the equations of the tangent to $y = x^3 - 2x^2 + 4$ at (2, 4).
3. a. Solve: $\sqrt{x}dy + y\,dx = 0$
   b. Define unit vector. If $\vec{b} = (b_1, b_2) \neq 0$, then find the unit vector in the direction of $\vec{b}$.
   c. If : $\vec{a} = (3,4)$ and $\vec{b} = (2,1)$, then find scalar and vector product of $\vec{a}$ and $\vec{b}$.
4. a. Find the weighted arithmetic mean of the first n natural numbers, the weights being the corresponding numbers.
   b. Find the standard deviation of 2, 3, 4, 5, 6.
   c. If P(A)=0.4, P(B)=0.35 and $P(A \cup B) = 0.55$, find $P(A \cap B)$. Are the two events A and B are in dependent ?

Contd...

5. a. A weight of 40N is supported by two light strings inclined at angles of 30^0 and 60^0 to the vertical. Determine the tensions in the strings.

   b. Define moment of a force F about a point O. Also give the geometrical interpretation of the moment.

   c. A Stone is dropped from a rising balloon at a height of 300m above the ground and it reaches the ground in 10 seconds. Find the velocity of the balloon at the instant, the stone was dropped. ($g = 9.8m/sec^2$)

6. a. A car covers a distance of 50m. in 5secs against a frictional force. If the power of the engine is 400W, find the frictional force.

   b. Find the derivative of *tanhx.*

   c. Integrate $\int \frac{dx}{x^2 + a^2}$.

Group 'B'

Attempt all the questions: $8 \times 2 \times 4 = 64$

7. a. A rubber ball is dropped from a height of 16 feet. At each rebound it rises to a height which is $\frac{3}{4}^{th}$ of the height of the previous fall. What is the total distance through which the ball will have moved before it finally comes to rest ?

   b. A candidate is required to answer 6 out of 10 questions which are divided into 2 groups each containing 5 questions and he is not permitted to attempt more than 4 from any group. In how many different ways can he makes up his choice ?

8. a. Show that $\frac{1}{2!} + \frac{1+2}{3!} + \frac{1+2+3}{4!} + ...\infty = \frac{e}{2}$.

   b. Determine the equation of the circle whose centre lies on $2x+y - 1=0$, radius 5 and through (4,3).

9. a. Obtain the condition for the line $lx + my + n = 0$ to be a tangent to the parabola $y^2 = kx$.

   Or

   Find the equation of the hyperbola in the standard form whose vertex is at (0, 8) and passing through $(4, 8\sqrt{2})$.

Contd...

b. Find from first principles, the derivative of $\log x^x$

or

Two cars start at the same time from the junction of two roads one on each road, with uniform speed v m.p.h. If the roads are inclined at 120^0, show that the distance between them increases at the rate of $\sqrt{3}\,v$ m.p.h.

10. a. Integrate: $\int \frac{dx}{a+b\cos x}(a<b)$

or

Solve: $\frac{dy}{dx}+\frac{y}{x^2}=\frac{1}{x^2}$

b. Prove by vector method.
sin(A+B) = sinAcosB+cosAsinB

11. a. Prove that the vectors $\vec{a}-2\vec{b}+3\vec{c},\ -2\vec{a}+3\vec{b}-4\vec{c},\ -\vec{b}+2\vec{c}$ are coplanar.

b. Prove that the sum of the squares of the deviations of the items is minimum when taken from the arithmetic mean.

12. a. Calculate Karl Pearson's coefficient of correlation from the following data.

x:	12	9	8	10	11	13	7
y:	14	8	6	9	11	12	3

b. What are the mean and variance of the binomial distribution. Find the binomial distribution having mean = 12 and variance = 8.

or

State and " Multiplication theorem of probability".

13. a. Two forces P and Q acting at a point have a resultant R. If Q is doubled, R is doubled and if Q is reversed in direction, R is again doubled. Show that P:Q:R= $\sqrt{2}:\sqrt{3}:\sqrt{2}$.

or

Two force P and Q acting parallel to the length and base of an inclined plane respectively, would each of them singly support a weight W on the plane, prove that $\frac{1}{P^2}-\frac{1}{Q^2}=\frac{1}{W^2}$.

Contd...

b. A pole of length 40m is placed with its end on a horizontal plane and is pulled by a string attached to its upper end, inclined at an angle 30^0 to the horizon. If the tension is equal to 60N, find the horizontal force which applied at a point 8m from the ground will keep the pole in a vertical position.

14. a. A particle slides down from rest from the top of a smooth plane of height 1962cms and inclination 30^o with the horizon. Divide the plane into three equal parts so that a particle at the top of the plane may describe each part in equal time. ($g = 981 cm/sec^2$)

b. Find the velocity and the direction of projection of a shot which passes in a horizontal direction just over the top of a wall which is 250m off and 125m high. ($g = 9.8 m/sec^2$)

or

A bullet passes through two planks in succession. Its initial velocity is 1200m/sec and it losses a velocity of 200m/sec in penetrating through each plank. Find the ratio of thickness of the planks, assuming that they offer the same average resistance.

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