New Course Model Question Set

Council for Technical Education and Vocational Training Office of the Controller of Examination, Sanothimi, Bhaktapur

Programs: Engineering (All) New Course
Year/Part: First Year/Second Semester
Subject: Mathematics- II

Full Marks: 80
Pass Marks: 32
Time: 3 hrs.

Attempt All Questions **Group- 'A' [(7 × 2) × 2 = 28]**

1. (a) What are roots of a quadratic equation? For what value of P will the equation $5x^2 - px + 45 = 0$ has equal roots?

   (b) Express, $3(\cos 120° + i \sin 120°)$ in the form of $a + ib$. Express into polar from to $(1 + i)$.

2. (a) If $A = \begin{pmatrix} -5 & 3 & 2 \\ 6 & 0 & 9 \\ 4 & 8 & 1 \end{pmatrix}$ then find the minor and co-factors of the element at a_{32} and a_{21}.

   (b) Find the open half plane of: $x + 2y \leq 8$ and its solution set also.

3. (a) Find the focus and length of latus rectum of the parabola: $y^2 = 16x$.

   (b) Define a hyperbola in conic section and write the equation of hyperbola whose centre is at (0, 0).

4. (a) Find the angle between two straight lines with direction cosines respectively l_1, m_1, n_1 and l_2, m_2, n_2. Also write their condition of parallel.

   (b) Write the values of direction ratios of the normal line to the plane: $2x - 3y + 6z = 7$.

5. (a) Find the vector $\vec{AB}$ and its magnitude if its initial point is at A (3, 2) and that of terminal point is B (1, – 6).

   (b) Prove that $\vec{a}.\vec{b} = 1$ if $\vec{a} = (\vec{i} + 3\vec{j} - 2\vec{k})$ and $\vec{b} = (6\vec{i} - \vec{j} + \vec{k})$.

6. (a) Find the vector perpendicular to $\vec{a}$ and $\vec{b}$ both and prove $\vec{a}.(\vec{a} \times \vec{b}) = 0$ where $\vec{a} = \vec{i} + 3\vec{j} + 4\vec{k}$ and $\vec{b} = 2\vec{i} + \vec{j} - \vec{k}$.

   (b) If 20% of electric bulbs manufactured by a company are defective, find the probability that out of 4 bulbs chosen at random, non will be defective.

7. (a) If two coins are tossed at once together then prepare its sample space and find the number of exhaustive cases.

   (b) Define a mode of a given data and if the values of mean and median of a frequency distribution are respectively 20 and 21 then find its mode.

Group - B [13 × 4 = 52]

8. If the roots of the quadratic equation $qx^2 + bx + b = 0$ be in the ratio of $p : q$ then prove that $\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}} + \sqrt{\frac{b}{a}} = 0$.

9. If $x + iy = \sqrt{\frac{1+i}{1-i}}$, prove that $x^2 + y^2 = 1$

OR Evaluate: $z^3 = i$ using the theorem

10. Prove that $\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ a^3 & b^3 & c^3 \end{vmatrix} = abc\,(a-b)\,(b-c)\,(c-a)$.

OR Find the inverse matrix at $\begin{pmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{pmatrix}$

11. Solve by Cramer's rule or by row-equivalent matrix method:
$x - 2y - 3z = 3$, $x + y - 2z = 7$ and $2x - 3y - 2z = 0$.

12. Find the optimum values of $F = 34x + 6y$ subject to: $x + y \le 6$, $x + y \ge 1$, $1 \le x \le 3$.

13. Find the equations of tangent and normal to the parabola $y^2 = 9x$ at (4, 6).

14. Find the centre, eccentricity, foci and length axes of the ellipse: $x^2 + 4y^2 - 4x + 24y + 24 = 0$.

15. Find the direction cosines of the lines whose direction cosines are given by the relations: $3l + m + 5n = 0$ and $6m - 2nl + 5lm = 0$.

16. Find the equation of the plane passing through the points (–1, 2, 3), (2, –3, 4) and perpendiculare to the plane $3x + y - z + 5 = 0$.

17. Show that the angle between two diagonals of a cube is $cos^{-1}\left(\frac{1}{3}\right)$ using vector rule.

18. Find the area of the parallelogram determined by the vectors $\vec{a} = \vec{i} + 2\vec{j} + 3\vec{k}$ and $\vec{b} = -3\vec{i} - 2\vec{j} + \vec{k}$. Also find sine of angle between them.

19. A coin is tossed successively three times. Find the probability of getting (a) no heads (b) exactly 2 heads (c) at least 2 heats (d) at most two heads.

OR The problem of hitting a target is $\frac{1}{4}$. If 5 hitting are made. Find the probability that (a) non strike the target (b) exactly one will strick the target (c) at most one strike the target.

20. Find the correlation coefficient from product moment method of the data:

x	12	9	8	10	11	13	7
y	14	8	6	2	11	12	3