Diploma in Civil Engineering / Diploma in Electrical & Mechanical Engineering

Term-End Examination

December, 2010

BET-011 : MATHEMATICS-I

Time : 2 hours *Maximum Marks : 70*

Note : *Question number 1 is **compulsory**. Attempt **any four** more questions out of the remaining questions numbered 2 to 6. Use of calculator is permitted.*

1. Answer *any seven* of the following : 7x2=14

   (a) Convert $2 \times \sqrt[3]{4}$ as a pure surd of order 6.

   (b) If the lines $3y - 2x = 4$ and $4y - px = 2$ are perpendicular, find the value of p.

   (c) Without solving, comment upon the nature of the roots of the equation $2x^2 + 8x + 9 = 0$.

   (d) Without using log tables, prove that
   $3 \log_{10}(1.5) + \log_{10}(240) - 2\log_{10}9 = 1$

   (e) Find the sum of first 51 terms of the A.P. whose second and third term are 14, 18 respectively.

   (f) Find the principal value of $\operatorname{cosec}^{-1}(-1)$.

(g) What is the meaning of the following box in a flow chart ?

(h) In the figure given below, PQ is a tangent to the circle. If $\angle BAQ = 55°$ and $\angle BAC = 45°$, find $\angle ABC$.
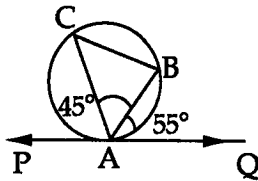
(i) Find the eccentricity of the hyperbola $3x^2 - y^2 = 4$.

(j) If $\vec{a} = 2\vec{i} + \vec{j} - \vec{k}$ and $\vec{b} = \vec{i} - \vec{j} + 3\vec{k}$

find $3\vec{a} \cdot \left(\vec{a} + \vec{b}\right)$.

2. (a) Without using trigonometric tables, find the value of   **4, 4, 6**

$$\frac{\cos^2 20° + \cos^2 70°}{\sin^2 20° + \sin^2 70°} + \sin^2 64° + \cos 64° \sin 26°.$$

(b) Prove that $\cot\theta + \tan\theta = \csc\theta \sec\theta$.

(c) A flag-staff stands on the top of a 5 m high tower. From a point on the ground the angle of elevation of the top of the flag staff is 60° and from the same point the angle of elevation of the top of the tower is 45°. Find the length of the flag-staff.

3. (a) Dot product of a vector $3i - 5k$, $2i + 7j$ and $i + j + k$ are respectively -1, 6 and 5. Find the vector. **5, 5, 4**

(b) Find the value of λ for which $a = \lambda i + 2j + k$ and $b = 4i - 9j + 2k$ are perpendicular.

(c) Find a vector of length 3 units and perpendicular to the vectors $3\vec{i} + \vec{j} - 4\vec{k}$

and $6\vec{i} + 5\vec{j} - 2\vec{k}$.

4. (a) The sum of four numbers in Geometric Progression is 60 and the Arithmetic mean between the first and the last is 18. Find the numbers. **5, 5, 4**

(b) Use the Binomial theorem to evaluate $(99)^4$.

(c) Simplify $\left\{ \sqrt[3]{x^4 y} \times \dfrac{1}{\sqrt[4]{x^2 y^8}} \right\}^{-6}$.

5.   (a)   Find the co-ordinates of the foot of the perpendicular dropped from the point P (3, 1) to the line AB whose equation is $2x - y = 3$.   5, 5, 4

     (b)   If a line passes through the point (1, 2) and cuts off positive intercepts on the x-axis and y-axis in the ratio of 2 : 3, find the equation of the line.

     (c)   Find the equation of the circle with centre (1, 3) and touching the line $3x + 4y + 5 = 0$.

6.   (a)   Find the equation of an ellipse whose focus is (1, 0), the directrix is $x + y + 1 = 0$ and eccentricity is $\dfrac{1}{\sqrt{2}}$.   5, 5, 4

     (b)   In a triangle ABC, if $a = 40$, $c = 40\sqrt{3}$ and $B = 30°$, solve the triangle.

     (c)   The length of a hall is 5m more than its breadth. If the area of the floor of the hall is 84 m^2, find the length and breadth of the hall.

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