

00225

**Diploma in Civil Engineering / Diploma  
in Electrical & Mechanical Engineering****Term-End Examination****June, 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) Express the following surd in the simplest

form :  $4\sqrt{\frac{16}{27}}$

(b)  $4x + 4y = 7$  is the equation of a line. Find the intercept on the  $y$ -axis and the angle made by this line with the positive direction of the  $x$ -axis.

(c) Without solving, comment upon the nature of roots of the quadratic equation  $25x^2 - 10x + 1 = 0$ .

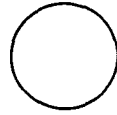
(d) If  $\log_{10} 2 = .30103$ , Evaluate  $\log_{10} \left( \frac{1000}{256} \right)$ .

(e) Find the sum of 19 terms of an A.P. whose  $n^{\text{th}}$  term is  $2n + 1$ .

(f) In a triangle ABC, prove that

$$\sin \frac{A + B}{2} = \cos \frac{C}{2}.$$

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



(h) The centre of a circle is  $(x, 5x + 3)$ . Find  $x$  if the circle passes through  $(7, 15)$  and length of its diameter is 10 units.

(i) Find the co-ordinates of the foci of the hyperbola  $3x^2 - y^2 = 4$ .

(j) If  $\vec{a} = 4\vec{i} - 2\vec{j} + \vec{k}$  and

$\vec{b} = \vec{i} + \vec{j} + 3\vec{k}$  find the projection of

$\vec{b}$  on  $\vec{a}$ .

2. (a) Without using tables Find the Value of 4

$$\frac{\cos 75^\circ}{\sin 15^\circ} + \frac{\sec 12^\circ}{\operatorname{cosec} 78^\circ} - \frac{\cot 18^\circ}{\tan 72^\circ}$$

- (b) Prove that  $\frac{\sin \theta - 2 \sin^3 \theta}{2 \cos^3 \theta - \cos \theta} = \tan \theta$ . 4

- (c) A tree stands vertically on the bank of a river. From a point on the other bank directly opposite the tree, the angle of elevation of the top of the tree is  $60^\circ$ . From a point 20 m behind this point on the same bank, the angle of elevation of the top of the tree is  $30^\circ$ . Find the height of the tree and the width of the river. 6

3. (a) Given two vectors a and b 5

$$a = 3i - 2j + k, \quad b = 2i + 3j$$

Compute  $|a|$ ,  $|b|$ ,  $a \cdot b$  and the angle between a and b.

- (b) Find a unit vector perpendicular to the vectors  $i - j + k$  and  $i + 2j - k$ . 4

- (c) Prove that for any vector  $\vec{a}$  5

$$i \times (a \times i) + j \times (a \times j) + k \times (a \times k) = 2 \vec{a}$$

4. (a) Insert 4 Geometric means between 3 and 96. 5  
Show that their product is the 4th power of  
the Geometric Mean between them.
- (b) Find the term independent of  $x$  in the 4  
expansion of  $\left(2x - \frac{1}{x}\right)^{10}$ .
- (c) If  $\frac{\sqrt{5}-1}{\sqrt{5}+1} + \frac{\sqrt{5}+1}{\sqrt{5}-1} = a + b\sqrt{5}$ . Find a 5  
and b.
5. (a) P lies on a line segment joining A(-3, 3) 5  
and B(12, -7) such that  $\frac{AP}{BP} = \frac{2}{3}$ . Find the  
co-ordinates of P and also the equation of  
line through P and perpendicular to AB.
- (b) Find the measure of the angle of intersection 4  
of the lines whose equations are  
 $3x + 4y + 7 = 0$  and  $4x - 3y + 5 = 0$ .
- (c) Find the equation of a circle of radius 5 5  
whose centre lies on  $x$ -axis and which  
passes through the point (2, 3).

6. (a) Find the focus, vertex and directrix of the parabola  $4y^2 + 12x - 12y + 39 = 0$ . 5
- (b) Solve the triangle ABC, given  $a = 20$  cm,  $b = 30$  cm,  $c = 21$  cm. 4
- (c) The hypotenuse of a right angled triangle is 25 cm and the difference between the length of the other two sides is 5 cm. Find the length of these sides. 5
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