

**DIPLOMA IN CIVIL ENGINEERING (DCLE(G))/
DIPLOMA IN MECHANICAL ENGINEERING
(DME) / DCLEVI / DMEVI / DELVI / DECVI /
DCSVI / ACCLEVI / ACMEVI / ACELVI /
ACECVI / ACCSVI**

Term-End Examination

December, 2019

00541

BET-011 : MATHEMATICS – I

Time : 2 hours

Maximum Marks : 70

Note : *Question number 1 is compulsory. Attempt any four questions out of the remaining questions. Use of scientific calculator is permitted.*

1. Choose the correct answer from the given four alternatives.

$$7 \times 2 = 14$$

- (i) $\cos 60^\circ + \sin 30^\circ + \cos^2 30^\circ$ is equal to

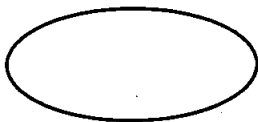
(a) $\frac{7}{4}$

(b) $\frac{4}{7}$

(c) $\frac{6}{7}$

(d) $\frac{2\sqrt{3}}{21}$

- (ii) If the angle of elevation of the tower at a distance of 300 m from the point of observation is 60° , then the height of the tower is
- (a) 300 m
 - (b) $300\sqrt{3}$ m
 - (c) 150 m
 - (d) $150\sqrt{3}$ m
- (iii) Slope of a horizontal line is
- (a) Undefined
 - (b) - 1
 - (c) 0
 - (d) None of the above
- (iv) What is the meaning of the following shape in a flow chart ?



- (a) Terminal box
- (b) Input/Output box
- (c) Decision box
- (d) Calculation/Assignment box

(v) If a circle passes through $(0, 0)$, $(a, 0)$ and $(0, b)$, then the coordinates of the centre are

(a) $\left(\frac{a}{2}, \frac{b}{2}\right)$

(b) $\left(\frac{b}{2}, \frac{a}{2}\right)$

(c) (a, b)

(d) (b, a)

(vi) Which of the following is **not** an example of a scalar ?

(a) Work

(b) Force

(c) Power

(d) Time

(vii) The angle between the vectors

$$2\hat{i} - 3\hat{j} + 5\hat{k} \text{ and } -2\hat{i} + 2\hat{j} + 2\hat{k} \text{ is}$$

(a) 90°

(b) 120°

(c) 0°

(d) $\tan^{-1} \frac{3}{4}$

2. (a) Determine the focus and the directrix of the parabola $y^2 = 8x$.

- (b) Determine the eccentricity of the ellipse

$$\frac{x^2}{64} + \frac{y^2}{28} = 1.$$

- (c) Compute the value of

$$\log_{16} 8 + \log_{27} 9 - \log_{125} 25. \quad 4+5+5$$

3. (a) If one root of the equation $x^2 + px + 12 = 0$ is 4, while the equation $x^2 + px + q = 0$ has equal roots, then find the value of 2.

- (b) A person standing on the bank of a river observes that the angle of elevation of the top of a tree on the opposite bank of the river is 60° and when he moves 40 m away from the tree, the angle of elevation becomes 30° . Determine the breadth of the river.

- (c) If ${}^nC_{12} = {}^nC_8$, then find out the value of n.

4+5+5

4. (a) Prove that :

$$(1 - \sin^2 \theta) \tan^2 \theta = \sin^2 \theta$$

- (b) If $\cos \theta = \frac{3}{5}$, then prove that

$$\frac{\sin \theta \tan \theta + 1}{2 \tan^2 \theta} = \frac{93}{160}.$$

- (c) Find the equation of the circle which passes through (4, 1) and (6, 5) and has its centre on the line $4x + y = 16$.

4+5+5

5. (a) What is the volume of the rectangular parallelepiped formed by the vectors $\hat{i}$, $2\hat{j}$ and $3\hat{k}$?

- (b) Find the value of

$$\log \left\{ \log_{ab} a + \frac{1}{\log_b ab} \right\}.$$

- (c) Show that the vectors $\mathbf{A} = 2\hat{i} - 3\hat{j} - \hat{k}$ and $\mathbf{B} = -6\hat{i} + 9\hat{j} + 3\hat{k}$ are parallel.

4+5+5

6. (a) If $\frac{\sqrt{3}-1}{\sqrt{3}+1} + \frac{\sqrt{3}+1}{\sqrt{3}-1} = a + b\sqrt{3}$, find a and b.

- (b) If x, y, z are three distinct numbers and

$$\frac{\log x}{y-z} = \frac{\log y}{z-x} = \frac{\log z}{x-y}, \text{ show that } x^x y^y z^z = 1.$$

- (c) Three numbers are in the ratio of 2 : 5 : 7. If 7 is subtracted from the second, the resulting numbers form an arithmetic sequence. Determine the original numbers. 4+5+5

7. (a) A geometric sequence has first term 3 and last term 48. If each term is twice the previous term, find the number of terms and the sum of the geometric sequence.
- (b) Find the term independent of x in the expansion of

$$\left(2x - \frac{1}{x}\right)^{10}.$$

- (c) Find the equation of the circle which is concentric with

$$x^2 + y^2 - 8x + 12y + 43 = 0,$$

and which passes through (6, 2).

4+5+5
