C09–C–**102**

3012

BOARD DIPLOMA EXAMINATION, (C–09)

MARCH/APRIL—2014

DCE—FIRST YEAR EXAMINATION

ENGINEERING MATHEMATICS—I

Time : 3 hours]　　　　　　　　　　　　　　　　[*Total Marks* : 80

PART—A　　　　　　　　　　　　3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed *five* simple sentences.

1. Rationalise the denominator of $\dfrac{\sqrt{13}-\sqrt{2}}{\sqrt{13}-\sqrt{2}}$.

2. If $p = 2x - y$, $q = y - 4z$, $r = z - 5x$, then find the value of $2p - 3q - 6r$ in terms of x, y, z.

3. Resolve $\dfrac{1}{(x-1)(x-3)}$ into partial fractions.

4. If $A + B + C = 180°$, prove that

$$\cot A \cot B + \cot B \cot C + \cot C \cot A = 1$$

5. Show that $\dfrac{\sin 2A}{1 - \cos 2A} = \cot A$.

6. Find the multiplicative inverse of $11 - 3i$.

7. Find the equation of the straight line passing through the point $(3, -4)$ and parallel to the line $x - 7y - 1 = 0$.

8. Find the equation of the point circle with centre $(3, -7)$.

9. Evaluate $\lim\limits_{x \to 0} \dfrac{\sin 33x}{\tan 11x}$.

10. Find the derivative of $3 \tan x - 4 \log x + 7x^3 + 9$.

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PART—B

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10×5=50

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Instructions : (1) Answer *any* **five** questions.

(2) Each question carries **ten** marks.

(3) The answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. *(a)* Using Laplace's expansion, evaluate

$$\begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix}$$

(b) Find the adjoint of

$$\begin{array}{ccc} 2 & 0 & 3 \\ 0 & 4 & 0 \\ 5 & 0 & 6 \end{array}$$

12. *(a)* If $A + B + C = 180°$, show that

$$\sin 2A + \sin 2B + \sin 2C = 4 \sin A \sin B \sin C$$

(b) Prove that

$$\tan^{-1} \frac{1}{13} + \tan^{-1} \frac{1}{15} = \tan^{-1} \frac{1}{98}$$

13. *(a)* Solve :

$$2 \sin^2 \theta + 1 = \cos \theta$$

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(b) In any $\triangle ABC$, prove that

$$b\cos^2 \frac{C}{2} + c\cos^2 \frac{B}{2} = S$$

14. (a) Find the vertex, focus, equation of directrix of the parabola

$$(y - 3)^2 = 4(x - 2)$$

(b) An archway is in the form of a semi-ellipse the major axis of which coincides with the road level. If the width of the road level is 30 m, and a pole of height is 6 m, just reaches the top when 5 m, from a side of the road, find the greatest height of the arch.

15. (a) Find the equation of the rectangular hyperbola whose focus is $(3, 1)$ and directrix is $4x - 3y - 2 = 0.$

(b) Find the centroid of the tetrahedron formed by the points $(2, 3, -4), (-3, 3, -2), (-1, 4, 2), (3, 5, 1).$

16. (a) If $y = \sqrt{\cot x + \sqrt{\cot x + \sqrt{\cot x + \cdots \text{to } \infty}}}$, show that

$$\frac{dy}{dx} = \frac{\cos ec^2 x}{1 - 2y}$$

(b) Find $\frac{dy}{dx}$, if $x^3 + y^3 = 24xy.$

17. (a) Find the length of tangent, normal, sub-tangent, sub-normal to the curve $y = x^3 + 2x + 5$ at $(1, 4).$

(b) A circular plate of metal expands by heat so that its radius increases at the rate of 0·03 cm/sec. At what rate is the surface increasing when the radius is 2 cm?

18. (a) Find the maximum and minimum values of

$$4x^3 - 9x^2 - 12x + 12$$

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(b) If there is an error of 0·4% in measuring the side of a square plate, find the percentage error in its area.

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