GOVERNMENT POLYTECHNIC, GAYA

Mid Term Examination for 1^{st} Semester Students

Course Name : Engineering Mathematics
Instructor: Mritunjay Kumar Singh
Date of Examination: 07 - 11 - 2019

Maximum Marks: 20
Time Allowed: $1\frac{1}{2}$ hours
Branch: Civil + Electronics

Notations have their usual meanings.

Section A

Attempt all problems. Each problem caries one mark.

1. The range of the function $y = \sin x$ is:
   (a) $(-1, 1)$ (b) $[-1, 1]$ (c) $(0, 1)$ (d) None of these.

2. For a one-one function $f(x)$, which of the following is true :
   (a) $f(x_1) \neq f(x_2) \implies x_1 = x_2$ (b) $f(x_1) = f(x_2) \implies x_1 = x_2$
   (c) $f(x_1) = f(x_2) \implies x_1 \neq x_2$ (d) None .

3. The value of $\lim_{x \to 0} \frac{1}{x^2+1}$ is :
   (a) 1 (b) 0 (c) ∞ (d) Does not exists .

4. If $f(x) = x^3 \tan x$, then $f'(0) =$
   (a) 1 (b) -1 (c) 0 (d) 2.

5. The smallest value of the polynomial $x^3 - 18x^2 + 96x$ in $[0, 9]$ is :
   (a) 126 (b) 128 (c) 135 (d) 160.

Section B

Solve any three problems. Each problem carries three marks.

6. Show that the function $f : \mathbb{R} \to \mathbb{R}$ given by $f(x) = x^3$ is injective.

7. Evaluate $\lim_{x \to 0} \dfrac{\sqrt{1+x} - \sqrt{1-x}}{x}$.

8. Show that $f(x) = |x|$ is not differentiable at $x = 0$.

9. Find the angle of intersection of the curves $xy = 6$ and $x^2y = 12$.

10. Using De Moivre's theorem prove that $\left(\frac{\cos\theta + i\sin\theta}{\sin\theta + i\cos\theta}\right)^4 = \cos 8\theta + i\sin 8\theta$.

Section C

Solve any one problem. Each problem caries six marks.

11. Find $\frac{dy}{dx}$, when $y = (1+x)^x + x^{1+x}$.

12. Show that all rectangles with a given perimeter, the square has the largest area.

13. Find the equation of tangent and normal at the point θ on the curve

$$x = a\sin^3\theta, y = b\cos^3\theta$$

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*** Best of Luck! ***