

**GOVERNMENT POLYTECHNIC, GAYA**  
**Mid Term Examination for 1<sup>st</sup> Semester Students**

Course Name : Basic Mathematics  
Instructor: Mritunjay Kumar Singh  
Date of Examination: 01 - 11 - 2018

Maximum Marks: 20  
Time Allowed: 1½ hours  
Branch: Mech. + Electrical + C. S. E.

Notations have their usual meanings.

## Section A

Attempt all problems. Each problem carries one mark.

1. If the degree of numerator  $N(x)$  is equal or greater than the degree of denominator  $D(x)$ , then the fraction is called :  
(a) Proper (b) Improper  
(c) Neither proper nor improper (d) Both proper nor Improper .
2. A matrix  $A = [a_{ij}]_{m \times n}$  is a square matrix if :  
(a)  $m < n$  (b)  $m > n$  (c)  $m = n$  (d) None of these.
3. The binomial coefficients of terms in the expansion of  $(x + a)^n$  equidistant from the beginning and the end are :  
(a) equal (b) 0 (c) equal but opposite sign (d) Never equal.
4. If  $\tan \alpha = \frac{x}{x+1}$  and  $\tan \beta = \frac{1}{2x+1}$ , then  $\alpha + \beta$  is :  
(a) 0 (b)  $\frac{\pi}{4}$  (c)  $\frac{\pi}{3}$  (d)  $\frac{\pi}{2}$ .
5. If the points  $(k, 3)$ ,  $(2, k)$ ,  $(-k, 3)$  are collinear, then the value of  $k$  can be :  
(a)  $-\frac{1}{2}, 1$  (b) 0, 3 (c) 1, 0 (d) 1, 2.

## Section B

Solve any three problems. Each problem carries three marks.

6. Express  $\frac{5x - 11}{2x^2 + x - 6}$  in partial fractions.

7. Find Inverse matrix ( $A^{-1}$ ) of the matrix

$$A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}.$$

8. If  $A + B = 45^\circ$ . Show that  $(\cot A - 1)(\cot B - 1) = 2$ .
9. Decide the type of triangle with vertices  $(4, 0), (-1, -1), (3, 5)$ .
10. Reduce the equation  $4x - 3y = 6$  into intercept form and find their intercept on axis.

## Section C

Solve any one problem. Each problem carries six marks.

11. Using Matrix method of Cramer rule solve the following system of linear equations:

$$3x + 2y - 2z = 3,$$

$$x + 2y + 3z = 6,$$

$$2x - y + z = 2.$$

12. Find the middle term in the expansion of

(a)  $\left(\frac{2x}{3} + \frac{3}{2x}\right)^{10}$

(b)  $\left(3 - \frac{x^3}{6}\right)^7$

13. (a) Find the values of  $a, b, c$  and  $d$  from the following equation:

$$\begin{bmatrix} 2a + b & a - 2b \\ 5c - d & 4c + 3d \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 11 & 24 \end{bmatrix}.$$

- (b) Show that the tangent of an angle between the lines  $\frac{x}{a} + \frac{y}{b} = 1$  and  $\frac{x}{a} - \frac{y}{b} = 1$  is  $\frac{2ab}{a^2 - b^2}$ .

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