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**NBC-101**

**(Following Paper ID and Roll No. to be filled in your Answer Book)**

**PAPER ID : 294101**

**Roll No.** | | | | | | | | | | |

# MCA

## (SEM. I) (ODD SEM.) THEORY EXAMINATION, 2014-15

### MATHEMATICS-I

Time : **3** Hours] [Total Marks : **100**

**Note :** Attempt All Questions. All Questions carry equal marks

1 Attempt any two parts of the following : **10×2=20**

(a) State Euler's theorem for partial differentiation of a homogeneous function. Verify it for the function

$$f(x, y) = \log\left(\frac{x^4 + y^4}{x + y}\right).$$

(b) State Leibnitz's theorem for successive differentiation of the product of two differentiable functions . Hence find the $n^{th}$ differential coefficient of $x^n \log x$.

(c) Trace the curve $r = a(1 + \cos\theta)$.

2 Attempt any two parts of the following : **10×2=20**

(a) Find the Expansion of the function $\log\left(1+e^{y}\right)$ in power of x up to five terms.

(b) Find the maximum or minimum of

$$x^4 - y^4 - 2x^2 + 4xy - 2y^2$$

(c) If $u = \frac{yz}{x}, v = \frac{zx}{y}$ and $w = \frac{xy}{z}$, then find the value of

$$\frac{\partial(u, v, w)}{\partial(x, y, z)}.$$

**3** Attempt any two parts of the following : **10×2=20**

(a) Using elementary transformation find the inverse

of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 5 & 7 & 11 \\ 13 & 17 & 19 \end{bmatrix}$.

(b) Find the eigne values and eigne vector of the matrix

$$\begin{bmatrix} 7 & 11 \\ 17 & 23 \end{bmatrix}.$$

(c) Define the rank and nullity of a linear transformation. Find the rank and nullity of the linear transformation $T ... R^3 \to R^3$ defined by

$$T(X, Y, Z) = (X + Y, Y + Z, Z + X).$$

4 Attempt any two parts of the following : **10×2=20**

(a) Evaluate $\iint x^2 + y^2$ over the first quadrant of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

(b) Define Gamma and Beta function. Prove that

$$\beta(m,n) = \frac{\overline{|(m)}\,\overline{|(n)}}{\overline{|(m+n)}}$$

(c) Find the volume of a segment of height h of a sphere of radius a.

5 Attempt any two parts of the following : **10×2=20**

(a) Define the gradient, divergence and curl, Find the divergence and curl of the vector function.

$$f(x, y, z) = xy\, i + yzj + zx\, k$$

(b) State Grean's theorem. Verify it in xy-plane for $\int_C \left(xy + y^2\right) dx + x^2 dy$. Where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.

(c) Define the solenoidal and irrotational vectors. Find the values of $a$ so that the following vector function $f(x, y, z) = zi + xj + ay\, k$ :

(i) is solenoidal

(ii) is irrotational.

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