Total No. of Questions – [05]　　　　　　Total No. of Printed Pages : 02

G.R. No.	

Paper Code :- U117-101 (RE- FF&F)

DECEMBER 2017 / ~~ENDSEM~~ RE-EXAM

F. Y. B. TECH. (COMMON) (SEMESTER - I)

Engineering Mathematics-I (ES11171)

(2017 PATTERN) SET-B

Time: [2 Hours]　　　　　　[Max. Marks: 50]

Instructions to candidates:

1) **Q.1 is comulsory.**
 Answer Q.2 OR Q.3, Q.4 OR Q.5
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required.**

Q.1) a) Find the rank of matrix $\begin{bmatrix} 4 & 1 & 0 \\ 0 & 3 & 8 \\ 0 & 0 & 5 \end{bmatrix}$. [2]

b) Find A^{-1} for an Orthogonal matrix $A = \frac{1}{\sqrt{2}}\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & -1 \end{bmatrix}$. [2]

C) Express given complex no. in polar form $\sqrt{2} + i$. [2]

d) By rotating vector $\overline{OA} = 1 + i\sqrt{3}$ in anticlockwise direction through an angle $\frac{\pi}{3}$, we get vector $\overline{OC}$, write the correct value of $\overline{OC}$ in polar form. [2]

e) If $y = (2x+4)^{30}$ then find y_{30}. [2]

f) If $y = x.e^{2x}$, then find y_n. [2]

g) Discuss convergence of the series $\sum_{n=1}^{\infty}\left(\frac{5}{3}\right)^n$. [2]

h) If $y = \sin^{-1}(3x - 4x^3)$, then write the series expansion for y. [2]

i) What will be the coefficient of x^5, in series expansion of $\cos x \cosh x$? [2]

j) Find characteristic polynomial of the matrix $\begin{bmatrix} 2 & -2 & 3 \\ 3 & -1 & 2 \\ 1 & 2 & -1 \end{bmatrix}$. [2]

P.T.O.

Q 2) a) Find the value of n for which $v = Ae^{-gx}\sin(nt - gx)$ satisfies the partial differential equation $\frac{\partial v}{\partial t} = \frac{\partial^2 v}{\partial x^2}$ where g, A are constants. [6]

b) If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x - y}\right)$, then prove that $x^2 u_{xx} + 2xyu_{xy} + y^2 u_{yy} = (1 - 4\sin^2 u)\sin 2u$. [6]

c) If $x = \frac{r}{2}(e^{\theta} + e^{-\theta})$ and $y = \frac{r}{2}(e^{\theta} - e^{-\theta})$ Prove that $\left(\frac{\partial r}{\partial x}\right)_y = \left(\frac{\partial x}{\partial r}\right)_{\theta}$. [4]

OR

Q3) a) If $u = f(x^2 - y^2, y^2 - z^2, z^2 - x^2)$ then prove that $\frac{1}{x}\frac{\partial u}{\partial x} + \frac{1}{y}\frac{\partial u}{\partial y} + \frac{1}{z}\frac{\partial u}{\partial z} = 0$. [6]

b) If $x = e^u \tan v,\ y = e^u \sec v$, find the value of $\left(x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}\right)\left(x\frac{\partial v}{\partial x} + y\frac{\partial v}{\partial y}\right)$. [6]

c) If $u = \log(x^3 + y^3 - x^2 y - y^2 x)$, prove that $\frac{\partial^2 u}{\partial x^2} + 2\frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} = \frac{-4}{(x+y)^2}$ [4]

Q4) a) If $x = r\cos\theta, y = r\sin\theta$ then evaluate J = $\frac{\partial(x,y)}{\partial(r,\theta)}$. and J'= $\frac{\partial(r,\theta)}{\partial(x,y)}$. Then Verify J.J' = 1 [6]

b) The H.P. required to propel a sterner varies as the cube of the velocity and square of the length. If there is 3% increase in velocity and 4% increase in length, find the % increase in H.P. [4]

c) Find the points on the surface $z^2 = xy + 1$ nearest to the origin, by using Lagrange's method. [4]

OR

Q5) a) Show that the minimum value of $xy + a^3\left(\frac{1}{x} + \frac{1}{y}\right)$ is $3a^2$ where x > 0 and y > 0. [6]

b) Examine for the functionally dependent for $u = \frac{x+y}{1-xy}, v = \tan^{-1} x + \tan^{-1} y$. Also find the relation between them if it exists. [4]

c) If $x + y + z = u, y + z = uv, z = uvw$, show that $\frac{\partial(x,y,z)}{\partial(u,v,w)} = u^2 v$. [4]

--ALL THE BEST--