Total No. of Questions – [5]　　　　Total No. of Printed Pages 2

G.R. No.	

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

DECEMBER 2017 / ~~ENDSEM~~ RE-EXAM

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

Engineering Mathematics I (ES11171)

Time : [2 Hours]　　(2017 PATTERN) (SET-C)　　[Max. Marks : 50]

Instructions to candidates:

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

Q.1) a) Find the rank of matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 2 & 4 \\ 1 & 3 & 6 \end{bmatrix}$. [2]

b) Find eigen values of the matrix $\begin{bmatrix} 1 & 0 \\ 5 & 4 \end{bmatrix}$. [2]

C) Find modulus & argument of complex no. $\frac{1+2i}{1-3i}$ [2]

d) By rotating vector $\overline{OA} = 5 + 6i$ in anticlockwise direction through an angle $\frac{\pi}{2}$, we get vector $\overline{OB}$, write the correct value of $\overline{OB}$ in polar form. [2]

e) If $y = \cos 4x$, then find y_n. [2]

f) If $y = \log(2x-1)$, then find y_n. [2]

g) State Lebnitz Theorem for n^{th} derivative of product of two functions. [2]

h) Discuss convergence of the series $\sum_{n=1}^{\infty} \frac{1}{n^{3/2}}$. [2]

i) Write down series expansion of $\tan^{-1} x$. [2]

j) Find the value of "b", for which the matrix $\frac{1}{3}\begin{bmatrix} b & 2 & 2 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ is orthogonal. [2]

P.T.O.

Q.2) a) If $u = f(r)$, where $r = \sqrt{x^2 + y^2 + z^2}$, prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = f''(r) + \frac{2}{r} f'(r)$. [6]

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

c) Verify $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$ for $u = tan^{-1}\left(\frac{x}{y}\right)$. [4]

OR

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

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

c) If $x = r\cos\theta, y = r\sin\theta$, Prove that $\left(\frac{\partial r}{\partial x}\right)_y = \left(\frac{\partial x}{\partial r}\right)_\theta$ [4]

Q4) a) For the transformation $x = e^u \cos v, y = e^u \sin v$ Prove that $\frac{\partial(x, y)}{\partial(u, v)} \cdot \frac{\partial(u, v)}{\partial(x, y)} = 1$. [6]

b) Find the approximate value of $\left[(0.98)^2 + (2.01)^2 + (1.94)^2\right]^{1/2}$. [4]

c) As the dimensions of a ΔABC are varied, show that the maximum value of cosA.cosB.cosC is obtained when the triangle is equilateral. Use Lagrange's method. [4]

OR

Q5) a) Determine the points where the function $x^3 + y^3 - 3axy$ is maximum or minimum. [6]

b) If $x = u + v + w$, $z = u^3 + v^3 + w^3$, $y = u^2 + v^2 + w^2$, then show that $\frac{\partial u}{\partial x} = \frac{vw}{(u - v)((u - w)}$. [4]

c) The period of a simple pendulum is $T = 2\pi\sqrt{\frac{l}{g}}$. Find the maximum percentage error in 'T' due to possible error up to 1% in 'l' and 2.5% in 'g'. [4]

---ALL THE BEST---