Total No. of Questions – [05]

Total No. of Printed Pages : 02

G.R. No.	

DECEMBER 2017 / ENDSEM

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

Engineering Mathematics-I (ES11171)

(2017 PATTERN) (SET-A)

Time: [2 Hours]

[Max. Marks: 50]

Instructions to candidates:

1) **Q.1 is comulsory.**
1) **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 $\begin{bmatrix} 1 & 3 & 6 \\ 1 & 4 & 5 \\ 1 & 5 & 4 \end{bmatrix}$. [2]

b) Find eigen values of the matrix $\begin{bmatrix} 14 & -10 \\ 5 & 1 \end{bmatrix}$. [2]

c) Find modulus & argument of complex number $\sqrt{\frac{1+i}{1-i}}$ [2]

d) Using Demoivre's theorem,find the value of $(1+i)^8 + (1-i)^8$. [2]

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

f) If $y = \frac{1}{(x+1)^3}$, then find y_n. [2]

g) Express given complex no. in polar form (-1 + i). [2]

h) Under what condition, Raabe's test is applied? Also state Raabe's test. [2]

i) Write the Series expansion for $f(x) = e^{-x}$. [2]

j) Write the Series expansion for $f(x) = coshx$. [2]

P.T.O.

Q 2) a) Find the value of n for which $z = t^n e^{-r^2/4t}$ satisfies the partial differential equation $\frac{1}{r^2}\left[\frac{\partial}{\partial r}\left(r^2\frac{\partial z}{\partial r}\right)\right] = \frac{\partial z}{\partial t}$. [6]

b) If $u = \operatorname{cosec}^{-1}\sqrt{\frac{x^{1/2}+y^{1/2}}{x^{1/3}+y^{1/3}}}$, show that $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x\partial y} + y^2\frac{\partial^2 u}{\partial y^2} = \frac{\tan u}{12}\left(\frac{13}{12} + \frac{\tan^2 u}{12}\right)$. [6]

c) If $u = f(x-y, y-z, z-x)$ then prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. [4]

OR

Q3) a) If $u = \log(x^3+y^3+z^3-3xyz)$, prove that $\left(\frac{\partial}{\partial x}+\frac{\partial}{\partial y}+\frac{\partial}{\partial z}\right)^2 u = \frac{-9}{(x+y+z)^2}$. [6]

b) If $u = \sin^{-1}(x^3+y^3)^{2/5}$, show that $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x\partial y} + y^2\frac{\partial^2 u}{\partial y^2} = \frac{6}{5}\tan u\left(\frac{6}{5}\sec^2 u - 1\right)$. [6]

c) If $u.x + v.y = 0,\ \frac{u}{x} + \frac{v}{y} = 1$, prove that $\left(\frac{\partial u}{\partial x}\right)_y - \left(\frac{\partial v}{\partial y}\right)_x = \frac{x^2+y^2}{y^2-x^2}$ [4]

Q4) a) If $x = u+v+w$, $z = u^3+v^3+w^3$, $y = u^2+v^2+w^2$, then show that $\frac{\partial u}{\partial x} = \frac{vw}{(u-v)((u-w)}$. [6]

b) The focal length of a mirror is found from $\frac{2}{f} = \frac{1}{v} - \frac{1}{u}$. Find the percentage error in f if u and v is both of error 2% each. [4]

c) Divide 120 into three parts such that the sum of their products taken two at a time shall be maximum. [4]

OR

Q5) a) Find the extreme values of $xy(a-x-y)$. [6]

b) Examine for the functionally dependent for $u = \sin^{-1}x + \sin^{-1}y, v = x\sqrt{1-y^2} + y\sqrt{1-x^2}$. Also find the relation between them if it exists. [4]

c) If the kinetic energy is $T = \frac{mV^2}{2}$. Find the approximate change in T as m changes from 49 to 49.5 and V changes from 1600 to 1590. [4]

--------------------ALL THE BEST--------------------