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

| G.R. No. | |
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December 2018/ BACKLOG

## F. Y. B.TECH. (COMMON) (SEMESTER - I) U118 - 101 (BE-FF)

## Engineering Mathematics I ( ES11171 )

Time : [2 Hours] (2017 PATTERN) [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 $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 8 & 12 \\ 2 & 4 & 6 \end{bmatrix}$. [2]

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

c) Find modulus & argument of complex number $\frac{1}{2}+\frac{\sqrt{3}}{2}i$. [2]

d) By rotating vector $\overline{OA} = 1 + i$ 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 $y = \log(x + 1)$, then find $y_n$. [2]

f) If $y = \sin(2x + 3)$, then find $y_n$. [2]

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

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

i) Write the series expansion for $sinhx$. [2]

j) Write the series expansion for $\cos x$. [2]

P.T.O.

Q.2) a) If $z=f(x,y)$ and $x=r\cosh\theta,\ y=r\sinh\theta$, then prove that $(x-y)\left(\frac{\partial z}{\partial x}-\frac{\partial z}{\partial y}\right)=r\frac{\partial z}{\partial r}-\frac{\partial z}{\partial \theta}$. [6]

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

c) If $z^3-zx-y=0$, prove that $\frac{\partial^2 z}{\partial x\partial y}=\frac{-\left(3z^2+x\right)}{\left(3z^2-x\right)^3}$. [4]

**OR**

Q.3) 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 $u=\cos ec^{-1}\sqrt{\frac{x^{1/2}+y^{1/2}}{x^{1/3}+y^{1/3}}}$, find the value of $x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}$. [6]

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

Q.4) a) For the transformation $x=r\cos\theta,\ y=r\sin\theta$ Prove that $\frac{\partial(x,y)}{\partial(r,\theta)}.\frac{\partial(r,\theta)}{\partial(x,y)}=1$. [6]

b) Find the possible percentage error in computing the parallel residence $r$ of two residences $r_1$ and $r_2$ from the formula: $\frac{1}{r}=\frac{1}{r_1}+\frac{1}{r_2}$, where $r_1$ and $r_2$ are both in error 2 % each. [4]

c) Use Lagrange's method to find the maximum value of $x^2y^3z^4$ such that $2x+3y+4z=9$. [4]

**OR**

Q.5) a) Find the extreme values of $x^3y^2(12-x-y)$ where $x,y>0$. [6]

b) If $u=xyz,\ v=x^2+y^2+z^2,\ w=x+y+z$, find $\frac{\partial x}{\partial u}$. [4]

c) In calculating the volume of a right circular cone errors of 2 % and 1 % are found in measuring height and base radius respectively. Find the percentage error in calculating the volume [4]

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