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

G.R. No.	

Paper code - U119-101 (BE-FS)

DECEMBER 2019/END SEM (Backlog)

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

COURSE NAME: Engineering Mathematics I

COURSE CODE: ES11171

(2017 PATTERN)

Time: [**2 Hours**] [Max. Marks: **50**]

(*) Instructions to candidates:
1) **Answer Q.1 OR Q.2, Q.3 OR Q.4 and 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)** If $z = e^{ax}\sin(by)$ then show that $z_{xy} = z_{yx}$ **[6 marks]**

b) If $x = r\cos\theta$, $y = r\sin\theta$ then find $\frac{\partial x}{\partial r}, \frac{\partial y}{\partial \theta}, \frac{\partial r}{\partial x}, \frac{\partial \theta}{\partial y}$ **[6 marks]**

c) if $z = \frac{x^2+y^2}{x-y}$ then find $x^2z_{xx} + 2xyz_{yx} + y^2z_{yy}$ **[4 marks]**

OR

Q.2) **a)** Find $x^2\mu_{xx} + 2xy\mu_{xy} + y^2\mu_{yy}$, if $\mu = \log\left(x^3 + y^3 - x^2y - xy^2\right)$ **[6 marks]**

b) If $u = x^2 - y^2 - 2xy$, where $x = e^t\sin t$, $y = e^t\cos t$ find $\frac{du}{dt}$ **[6 marks]**

c) If $z = \frac{x^2+y^2+2xy}{x-y}$ then find value of $x^2z_{xx} + 2xyz_{yx} + y^2z_{yy}$. **[4 marks]**

Q.3) **a)** If $x = r\cos\theta$, $y = r\sin\theta$, prove that $JJ' = 1$. **[6 marks]**

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

c) If $x^2 + y^2 + u^2 - v^2 = 0$ and $uv + xy = 0$, prove that $\frac{\partial(u,v)}{\partial(x,y)} = \frac{x^2 - y^2}{u^2 + v^2}$. **[4 marks]**

OR

Q.4) **a)** Find maximum and minimum values of $3x^2 - y^2 + x^3$. **[6 marks]**

b) If $x = e^u\cos v$, $y = e^u\sin v$, prove that $\frac{\partial(x,y)}{\partial(u,v)} \cdot \frac{\partial(u,v)}{\partial(x,y)} = 1$. **[4 marks]**

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

Q.5) Attempt all MCQ'S **[2x10=20 marks]**

a. Rank of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$ is

i) 1 ii) 2 iii)3 iv) None of these

b. If A is an Skew symmetric matrix of order 7 by 7 then which of the following statement is correct

i) Rank of matrix= 7
ii) Rank of matrix > 7
iii) Rank of matrix < 7
iv) None of these

c. If 2 and 3 are the eigen value of 2 by 2 matrix then trace of given matrix is

i. 5 ii) -1 iii) 1 iv) -6

d. Real part $\log\left(\frac{3+4i}{3-4i}\right)$ is

i. 1 ii) $\tan^{-1}\frac{4}{3}$ iii) 2 log 5 iv) 0

e. The value of $(\sin\theta+\cos\theta)^n$ is

i) $(\cos n\theta+\sin n\theta)$ ii) $\cos\left(n\theta+\frac{\pi}{2}\right)+i\sin\left(n\theta+\frac{\pi}{2}\right)$

iii) $\cos\left(-n\theta+\frac{n\pi}{2}\right)+i\sin\left(-n\theta+\frac{n\pi}{2}\right)$ iv) none of these

f. In the expansion of cosx about x = 0, the coefficient of x^6 is

i) $\frac{1}{6}$ ii) $-\frac{1}{6!}$ iii) 0 iv) $\frac{1}{6!}$

g. The series $\sum_{n=1}^{\infty} n$ is

i) Convergent ii) Divergent iii) Oscillatory iv) none of these

h. The series $\sum_{n=1}^{\infty} n^{1/n}$ is

i) Convergent ii) Divergent iii) Oscillatory iv) none of these

i. The value of $\lim_{x\to 0}\frac{1-\cos x}{x^2}$ *is*

i) 1 ii) -1 iii) 0 iv) 1/2

j. The nth term of the series $\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{9}}+\frac{1}{\sqrt{28}}+\frac{1}{\sqrt{65}}+---$ is

i. $\frac{1}{\sqrt{n^2+1}}$ ii) $\frac{1}{\sqrt{n^3}}$ iii) $\frac{1}{\sqrt{n^3+1}}$ iv) $\frac{1}{\sqrt{n+1}}$