Total No. of Questions – [08]   Total No. of Printed Pages :02

G.R. No.	

Paper Code- U218-151 (BE-FF)

S. Y. B. TECH. (MECHANICAL ENGINEERING) (SEMESTER - I)

COURSE NAME: Engineering Mathematics III

COURSE CODE: MEUA21171

(PATTERN 2017)

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

Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8**
2) **Figures to the right indicate full ..**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q.1) a) $(D-2)^2 y = 8(e^{2x} + \sin 2x + x^2)$ [6]

OR

b) $x^2 \frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 3y = x^2 \sin(\log x)$ [6]

Q.2) a.Find the Fourier cosine integral representation for the function $f(x) = \begin{cases} x^2, & 0 < x < a \\ 0, & x > a \end{cases}$

[6 .]

OR

b) Find Laplace transform of $t^2 e^{-2t} \sin t \cos 2t$ [6]

Q.3) a) The first four moments about the working mean 30.2 of a distribution are 0.255, 6.222, 30.211 and 400.25. Calculate the first four moments about the mean and also evaluate β_1, β_2.

[6]

OR

b) In a normal distribution 7% of the items are under 35 and 89% are under 63. Find the mean and standard deviation.

(Given: For z=1.475 area A=0.43, z=1.226 area A=0.39). [6]

Q.4) a) Show that $\bar{F} = (y^2 cosx + z^2)\bar{\imath} + (2ysinx)\bar{\jmath} + (2xz)\bar{k}$ is irrotational and find the scalar $\emptyset$ such that $\bar{F} = \nabla\emptyset$. [4]

OR

b) Prove That $\nabla \cdot (\phi\nabla\varphi - \varphi\nabla\phi) = \phi\nabla^2\varphi - \varphi\nabla^2\phi$ [4]

Q. 5 a)) Find the work done in moving a particle from $(0,1,-1) to \left(\frac{\pi}{2},-1,2\right)$ in a force field $\bar{F} = (y^2 \cos x + z^3)\hat{\imath} + (2y \sin x - 4)\hat{\jmath} + (3xz^2 + 2)\hat{k}$. [6]

b) $\int_C (4y\, dx + 2z\, dy + 6y\, dz)$ where C is curve of intersection of $x^2 + y^2 + z^2 = 6z$

and z = x + 3. [4]

c) Show that $\iint_S \left(\frac{\bar{r}}{r^3}\right).\hat{n}\, dS = 0.$ [4]

OR

Q.6) a)) Verify Green's Theorem for:

$\bar{F} = x\hat{\imath} + y^2\hat{\jmath}$ over the first quadrant of the circle $x^2 + y^2 = 1$. [6]

b) Evaluate $\iint_S (yz\,\bar{\imath} + zx\,\bar{\jmath} + xy\,\bar{k}).d\bar{S}$ where S is surface of the sphere

$x^2 + y^2 + z^2 = 1$ in the positive octant. [4]

c) Using Stoke's Theorem evaluate following line integral:

$\int_C (y\,dx + z\,dy + x\,dz)$ where C is the curve of intersection of $x^2 + y^2 + z^2 = a^2$ and $x + z = a$.

[4]

Q.7) a) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ if i) u is finite for all t , ii) u = 0 when x = 0, π for all t

iii) u= $\pi x - x^2$ when t = 0 and $0 \le x\ \pi\ \pi$ [6]

b) A rectangular plate with insulated surface is 10cm wide and so long compared to its width that it may be considered infinite in length without introducing an appreciable error . If the temperature along short edge y=0 is given

$u(x,0) = 100\sin\frac{\pi x}{10}, 0 \le x \le 10$, while the two long edges x = 0 and x = 10 as well as the other short edge are kept at 0^o C . State the conditions in mathematical form. [4]

c) In Q.7 b, Find steady-state temperature u(x,y). [4]

OR

Q.8 A homogeneous rod of conducting material of length 100cm has its ends kept at zero temperature and the temperature initially is

$$u(x,0) = \begin{cases} x & 0 \le x \le 50 \\ 100 - x & 50 \le x \le 100 \end{cases}$$ Find the tempereture u(x,t) at any time . [6]

b) A tightly stretched string with fixed end points x=0 and x=l is initially in a position given by $y(x,0) = y_0 \sin^3 \frac{\pi x}{l}$. If it is released from rest from this position, state the condition in mathematical form. [4]

c) Find the displacement y in the above problem Q. 7 b at any distance x from one end and at any time t. [4]