Total No. of Questions – [ ] Total No. of Printed Pages : 3

G.R. No.	

U218-151 (ESE)

DECEMBER 2018/ENDSEM

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

COURSE NAME: Engineering Mathematics III

COURSE CODE: MEUA21171

(PATTERN 2017)

Time: [**2 Hours**] [Max. Marks: **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 marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q.1) a) $(D^2+9)y = x^3+2x-\cos 3x$ [6 marks]

OR

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

Q.2) a) Using Fourier integral representation, show that

$\int_0^\infty \frac{\lambda^3 \sin\lambda x}{\lambda^4+4}\, d\lambda = \frac{\pi}{2} e^{-x}\cos x$, where x > 0 [6 marks]

OR

b) Find inverse Laplace transform of $\frac{s}{s^4+1}$ [6 marks]

Q.3) a) The first four moments of a distribution about the value 5 are 2, 20, 40 and 50. Calculate the first four central moments, mean, standard deviation, coefficient of skewness and kurtosis [6 marks]

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 marks]

Q.4) a) Show that $\bar{F} = (6xy+z^3)\bar{i}+(3x^2-z)\bar{j} +(3xz^2-y)\bar{k}$ is irrotational.
Find scalar ϕ such that $\bar{F}=\nabla\phi$ [4 marks]

OR

b) $\nabla^2(\phi\varphi)=\phi\nabla^2\varphi+2\nabla\phi\cdot\nabla\varphi+\varphi\nabla^2\phi$ [4 marks]

Q. 5 a) Find the work done in moving a particle from $(1,1,1)$ *to* $(3,-5,7)$ in a force field $\bar{F} = (x^2 - yz)\hat{\imath} + (y^2 - zx)\hat{\jmath} + (z^2 - xy)\hat{k}$ [6 marks]

b) Using Stoke's Theorem evaluate following line integrals $\int_C (4y\,dx + 2z\,dy + 6y\,dz)$ where C is curve of intersection of $x^2 + y^2 + z^2 = 2z$ and $x = z - 1$. [4 marks]

c) Show that $\iiint_V \frac{dV}{r^2} = \iint_S \left(\frac{\bar{r}}{r^2}\right).\hat{n}\,dS$ [4 marks]

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 $x^2 + y^2 = a^2$. [6 marks]

b) Using Stoke's Theorem evaluate following line integrals:

$\int_C (y\,dx + z\,dy + x\,dz)$ where C is the curve of intersection of $x^2 + y^2 + z^2 = a^2$ and $x + z = a$. [4 marks]

c) Evaluate $\iint_S (y^2z^2\,\bar{\imath} + z^2x^2\,\bar{\jmath} + x^2y^2\,\bar{k}).d\bar{S}$ where S is surface of the sphere $x^2 + y^2 + z^2 = a^2$ in the positive octant. [4 marks]

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 $0 \le x \prec \pi$ [6 marks]

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° C . State the conditions in mathematical form. [4 marks]

c) In Q.~~8~~ 7 b, Find steady-state temperature u(x,y). [4 marks]

OR

Q.8) a) 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, find the displacement y at any distance x from one end and at any time t.

[6marks]

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 marks]

c) Find the displacement y in the above problem Q.8 b at any distance x from one end and at any time t. [4 marks]
