

## **SUBJECT: ENGINEERING MATHEMATICS-III**

Day : Thursday  
Date : 09/05/2019

S-2019-2970

Time : 02.30 PM TO 05.30 PM  
Max. Marks: 80

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**N. B. :**

- 1)** **Q. No.1 and Q. No.5** are **COMPULSORY**. Out of the remaining attempt **ANY TWO** questions from Section-I and **ANY TWO** questions from Section-II.

**2)** Figures to the right indicate **FULL** marks.

**3)** Answer to the both sections should be written in **SAME** answer book.

**4)** Assume suitable data, if necessary.

**5)** Use of non-programmable **CALCULATOR** is allowed.

**6)** Draw neat and labeled diagram **WHEREVER** necessary.

## **SECTION-I**

**Q.1 a)** Solve:  $(2x+1)^2 \frac{d^2y}{dx^2} - 2(2x+1) \frac{dy}{dx} - 12y = 6x.$  (05)

b) Find the Fourier cosine transform of  $f(x) = e^{-2x} + 4e^{-3x}$ . (04)

c) If  $f(z) = u + iv$  is analytic, find  $f(z)$ , if  $u - v = (x - y)(x^2 + 4xy + y^2)$ . (05)

$$\text{a) } (D^2 + 1)y = \sin x \cdot \sin 2x.$$

$$\text{b) } (D^2 - 1)y = (1 + x^2)e^x.$$

c)  $(D^2 - 7D + 6)y = e^{2x}$

d)  $(D^2 + 1)y = \tan x$  (By method of variation of parameters).

**Q.3** a) Evaluate  $\int_C (z+z^2) dz$ , Where C is the upper arc of the circle  $|z|=1$ . (04)

b) Evaluate  $\int_0^{2\pi} \frac{d\theta}{(5 - 3\cos\theta)^2}$ . (05)

c) Find the map of the straight line  $y = x$  under the transformation  $w = \frac{z-1}{z+1}$ . (04)

**Q.4** a) Using inverse sine transform, find  $f(x)$  if  $F_s(\lambda) = \frac{1}{\lambda} e^{-ax}$ . (05)

b) Find the Fourier cosine integral representation for the function, (04)

$$f(x) = \begin{cases} x, & 0 \leq x \leq a \\ 0, & x > a \end{cases}$$

c) Find  $z\{f(k)\}$  where  $f(k) = 4^k + 5^k$ ,  $k \geq 0$ . (04)

P.T.O.

## SECTION-II

**Q.5 a)** Find the Laplace transform of the following: (06)

$$\text{i) } \int_0^t \frac{\sin t}{t} dt \quad \text{ii) } e^{-4t} \int_0^t t \sin 3t dt.$$

- b)** Find the work done in moving a particle once round the circle  $x^2 + y^2 = a^2$ ,  $z = 0$  under the field of force  $\vec{F} = \sin y \vec{i} + x(1 + \cos y) \vec{j}$ . (04)
- c)** Find directional derivative of  $\phi = x^2yz + 4xz^2$  at the point  $(1, -2, -1)$  in the direction of vector  $2\vec{i} - \vec{j} - 2\vec{k}$ . (04)

**Q.6 a)** Find the inverse Laplace transform of  $\frac{s^2 + 2}{s(s^2 + 4)}$ . (04)

**b)** Find inverse Laplace transform of  $\log\left(\frac{s+3}{s+2}\right)$ . (04)

**c)** Solve the differential equation. (05)

$$\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = 12e^{-2t}, \quad y(0)=2, \quad y'(0)=6.$$

**Q.7 a)** Verify whether  $\vec{F} = 2xyz^2 \vec{i} + (x^2z^2 + z \cos yz) \vec{j} + (2x^2yz + y \cos yz) \vec{k}$  is irrotational. If so, find corresponding scalar potential  $\phi$ . (05)

**b)** Show that  $\nabla^4(r^2 \log r) = \frac{6}{r^2}$ . (04)

**c)** If  $\vec{u}$  and  $\vec{v}$  are irrotational vectors then prove that  $\vec{u} \times \vec{v}$  is solenoidal vector. (04)

**Q.8 a)** Verify the Gauss- divergence theorem for the function (07)

$\vec{F} = x \vec{i} + y \vec{j} + z^2 \vec{k}$  over the cylindrical region bounded by  $x^2 + y^2 = 4$ ,  $z=0$ ,  $z=2$ .

**b)** Use stoke's theorem to evaluate  $\int_C (4y \vec{i} + 2z \vec{j} + 6y \vec{k}) \cdot d\vec{r}$ , Where C is the curve of intersection of  $x^2 + y^2 + z^2 = 2z$  and  $x = z - 1$ . (06)

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