

B.Tech. SEM -III Electrical/ Electronics / Bio Medical / E & TC) 2014
Course (CBCS) : WINTER - 2018
SUBJECT : ENGINEERING MATHEMATICS - III

Day : Friday
Date : 23/11/2018

W-2018-2296

Time : 10.00 AM TO 01.00 PM
Max. Marks : 60

N. B. :

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Draw neat and labeled diagram **WHEREVER** necessary.
- 4) Use on non-programmable calculator is **ALLOWED**.
- 5) Assume suitable data, if necessary.

Q.1 a) Solve : $\frac{d^3 y}{dx^3} - \frac{d^2 y}{dx^2} = 3x + x e^x$ (05)

- b) Solve the following differential equation by the method of variation of parameters. (05)

$$\frac{d^2 y}{dx^2} + y = x \sin x$$

OR

a) Solve : $x^2 \frac{d^2 y}{dx^2} - 4x \frac{dy}{dx} + 6y = x^5$ (05)

b) Solve : $\frac{dx}{y} = \frac{-dy}{x} = \frac{dz}{xe^{(x^2+y^2)}}$ (05)

Q.2 a) If $V = 3x^2 y - y^3$, find analytic function $f(z)$ in terms of z . (05)

b) Evaluate : $\int_c \frac{e^{-z}}{z+1} dz$, where c is a circle $|z| = 2$. (05)

OR

a) Find the bilinear transformation which maps the points $z = 1, -i, -1$ to the points $w = i, 0, -i$ respectively. (05)

b) Prove that, analytic function with constant modulus is constant. (05)

Q.3 Find the Fourier transform of $f(x) = e^{-|x|}$ (10)

OR

a) Find the z -transform: (05)

$$f(k) = \begin{cases} 3^k, & k < 0 \\ 2^k, & k \geq 0 \end{cases}$$

b) Find : $z^{-1} \left(\frac{z(z+1)}{z^2 - 2z + 1} \right), |z| > 1$ (05)

P. T. O.

Q. 4 a) Find the Laplace transform: (05)

$$f(t) = \frac{1 - \cos t}{t^2}$$

b) Find the inverse Laplace transform: (05)

$$F(s) = \frac{11s^2 - 2s + 5}{(s - 2)(2s - 1)(s + 1)}$$

OR

Find the solution of the following differential equation: (10)

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

Q. 5 a) Find the directional derivative of (05)

$$\phi = xy^2 + yz^3 \text{ at } (2, -1, 1) \text{ along the vector } \bar{i} + 5\bar{j} + 6\bar{k}.$$

b) Show that: (05)

$$\nabla^2 f(r) = \frac{d^2 f}{dr^2} + \frac{2}{r} \frac{df}{dr}$$

OR

a) Evaluate : $\nabla^4 e^r$ (05)

b) Find $\nabla \phi$ for (05)

$$\phi = \log(x^2 + y^2 + z^2)$$

Q. 6 a) Find: $\iiint_V \frac{dv}{r^2}$ (05)

b) Find the work done in moving a particle along (05)

$$x = a \cos \theta, \quad y = a \sin \theta, \quad z = b\theta \text{ from } \theta = \frac{\pi}{4} \text{ to } \theta = \frac{\pi}{2}$$

under a field of force give by :

$$\bar{F} = -3a \sin^2 \theta \cos \theta \bar{i} + a(2 \sin \theta - 2 \sin^3 \theta) \bar{j} + b \sin 2\theta \bar{k}$$

OR

Verify divergence theorem for $\bar{F} = 4xz\bar{i} - y^2\bar{j} + yz\bar{k}$ and S , the surface of (10)
the cube bounded by the planes $x = 0, x = 2, y = 0, y = 2, z = 0, z = 2$.

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