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

**SUBJECT : ENGINEERING MATHEMATICS - III**

Day : Friday | **W-2018-2296** | Time : 10.00 AM TO 01.00 PM

Date : 23/11/2018 | 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.

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

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

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

**OR**

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

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

**Q. 2** **a)** If $V = 3x^2y - y^3$, 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 $w = i, o, -i$ 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)**

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

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

$\phi = xy^2 + yz^3$ at $(2, -1, 1)$ 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)**

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

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

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

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

under a field of force give by :

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

**OR**

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

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