B.TECH. SEM -III ELECTRICAL/ ELECTRONICS / BIO MEDICAL / E & TC) 2014 COURSE (CBCS) : SUMMER - 2018

SUBJECT: ENGINEERING MATHEMATICS - III

Day: **Monday** Time: **02.30 PM TO 05.30 PM**
Date: **21/05/2018** **S-2018-2240** Max. Marks: 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non programmable **CALCULATOR** is allowed.

Q.1 **a)** Solve: $\left(D^4 - m^4\right)y = \sin mx.$ **(05)**

b) Solve: $\dfrac{dx}{mz - ny} = \dfrac{dy}{nx - lz} = \dfrac{dz}{ly - mx}.$ **(05)**

OR

a) Solve: $\left(D^4 + 4\right)y = 4\sec^2 2x$ by the method of variation of parameters. **(05)**

b) Solve: $(1+x)^2 \dfrac{d^2y}{dx^2} + (1+x)\dfrac{dy}{dx} + y = 2\sin\left[\log(1+x)\right].$ **(05)**

Q.2 **a)** If $v = 3x^2y - y^3$, find its harmonic conjugate u. Find $f(z) = u + iv$ in terms of z. **(05)**

b) Evaluate: $\oint_C \dfrac{\sin 2z}{\left(z + \dfrac{\pi}{3}\right)^4} dz$, where '$C$' is $|z| = 2$. **(05)**

OR

a) Evaluate: $\int_0^{2\pi} \dfrac{d\theta}{5 + 4\sin\theta}$ **(05)**

b) Find the map of the straight line $y = x$ under the transformation $w = \dfrac{z-1}{z+1}$. **(05)**

Q.3 **a)** Find $z\{f(k)\}$ where $f(k) = \sin\left(\dfrac{k\pi}{4} + \alpha\right), k \geq 0.$ **(05)**

b) Find: $Z^{-1}\left[\dfrac{z}{(z-1)(z-2)}\right]$, if $|z| \geq 2.$ **(05)**

OR

a) Find the Fourier cosine transform of $f(x) = e^{-x} + e^{-2x}$ $(x > 0)$. **(05)**

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

Q.4

a) Obtain the Laplace transform of $\int_0^\infty \frac{\cos 6t - \cos 4t}{t}\, dt$ **(05)**

b) Obtain the Laplace transform of $\int_0^t t\, e^{-4t} \sin 3t\, dt.$ **(05)**

OR

a) Obtain the inverse Laplace transform of $\frac{3s+1}{(s-1)(s^2+1)}.$ **(05)**

b) Obtain the inverse Laplace transform of $\frac{1}{s} \log\left(\frac{s+3}{s+2}\right).$ **(05)**

Q.5 a) For the curve $x = \cos t + t \sin t$, $y = \sin t - t \cos t$, find the tangential and normal components of acceleration at any time t. **(05)**

b) For a solenoidal vector field $\vec{E}$, show that curl curl curl curl $\vec{E} = \nabla^4 \vec{E}.$ **(05)**

OR

a) Show that the vector field given by $\vec{F} = (y^2 \cos x + z^2)\vec{i} + (2y \sin x)\vec{j} + 2xz\vec{k}$ is irrotational and find scalar field such that $\vec{F} = \nabla\phi.$ **(05)**

b) Find the directional derivative of the function $\phi = e^{2x-y-z}$ at $(1,1,1)$ in the direction of the tangent to the curve $x = e^{-t}, y = 2\sin t + 1, z = t - \cos t$ at $t = 0.$ **(05)**

Q.6 Verify divergence theorem for the function $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ and S is the surface of the cube bounded by the planes $x = 0, x = 2, y = 0, y = 2, z = 0, z = 2.$ **(10)**

OR

Verify Stoke's theorem for $\vec{F} = -y^3\vec{i} + x^3\vec{j}$ and the closed curve C is the boundary of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$ **(10)**

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