## B.TECH. SEM -IV (CHEMICAL ) 2014 COURSE (CBCS) : SUMMER - 2018

## SUBJECT : ENGINEERING MATHEMATICS - III

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| Day : **Saturday** | | **S-2018-2270** | Time : **10.00 AM TO 01.00 PM** |
| Date : **02/06/2018** | | | 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.
4) Assume suitable data if necessary.
5) Draw neat and labeled diagrams **WHEREVER** necessary.

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**Q.1** Solve any **THREE:** **(10)**

**i)** $(D^3 + D)y = \cos x$

**ii)** $(D^2 - 2D + 5)y = 25x^2$

**iii)** $(D^2 - 1)y = \cosh x.\cos x$

**iv)** $(D^3 - 7D - 6)y = e^{2x}(1 + x)$

**OR**

**a)** Solve differential equation $(2x+3)^2 \dfrac{d^2y}{dx^2} - 2(2x+3)\dfrac{dy}{dx} - 12y = 6x$ . **(05)**

**b)** Solve differential equation by the method of variation of parameters $(D^2 - 6D + 9)y = \dfrac{e^{3x}}{x^2}$ . **(05)**

**Q.2** Solve $\dfrac{\partial V}{\partial t} = k\dfrac{\partial^2 V}{\partial x^2}$ if **(10)**

**i)** $V(0,t) = 0$

**ii)** $V_x(l,t) = 0$

**iii)** $V(x,t)$ is bounded and

**iv)** $V(x,0) = \dfrac{V_0 x}{l}$ for $0 \le x \le l$.

**OR**

Solve the equations $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$ with conditions. **(10)**

**i)** $u(x,0) = 0,$

**ii)** $u(x,l) = 0,$

**iii)** $u(\infty, y) = 0,$

**iv)** $u(0, y) = x$

**Q.3 a)** Find the Fourier cosine transform of the function $f(x) = e^{-2x} + 4e^{-3x}$ . **(05)**

**b)** Using inverse Fourier sine transform, find $f(x)$, if $F_S(\lambda) = \dfrac{\lambda}{1+\lambda^2}$ . **(05)**

**OR**

Find the Fourier sine transform of $\dfrac{e^{-bx}}{x}$ and hence evaluate $\displaystyle\int_0^\infty \tan^{-1}\left(\frac{x}{b}\right).\sin x\,dx$ . **(10)**

P.T.O.

**Q.4** **a)** Solve the differential equation by using Laplace transform **(05)**
$y'' - 3y' = 9,\ y(0) = y'(0) = 0$.

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

**OR**

**a)** Obtain the Laplace transform of $e^{-3t}\int_0^t \frac{\sin 2t}{t}\,dt$ . **(05)**

**b)** Find the Laplace transform of $\sin(\omega t + \alpha)$ . **(05)**

**Q.5** **a)** Find directional derivative of $\phi = xy^2 + yz^3$ at point (2, -1, 1) along line $2(x-2) = (y+1) = (z-1)$. **(05)**

**b)** Show that $\nabla^4(r^2 \log r) = \frac{6}{r^2}$ . **(05)**

**OR**

**a)** Find constants $a, b, c$ so that **(05)**
$\vec{F} = (x + 2y + az)\vec{i} + (bx - 3y - z)\vec{j} + (4x + cy + 2z)\vec{k}$ is irrotational.

**b)** If $\vec{F} = (x^2 - y^2 + 2xz)\vec{i} + (xz - xy + yz)\vec{j} + (z^2 + x^2)\vec{k}$ then show that Curl $\vec{F}$ at (1, 2, -3) and (2, 3, 12) are orthogonal. **(05)**

**Q.6** Verify the divergence theorem for the function $\vec{F} = x\vec{i} + y\vec{j} + z^2\vec{k}$ over the cylindrical region bounded by $x^2 + y^2 = 4,\ z = 0,\ z = 2$ . **(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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