B.Tech. SEM -IV Info. Tech. 2014 Course (CBCS) : WINTER - 2018

SUBJECT: ENGINEERING MATHEMATICS - III

Day: Tuesday **W-2018-2352** Time: 02.30 PM TO 05.30 PM

Date: 13/11/2018 Max. Marks: 60

N.B. :

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Draw diagrams **wherever** necessary.
4) Use of non-programmable **calculator** is allowed.

Q.1 Solve the following differential equation $\frac{d^2y}{dx^2} - y = e^{-x}\sin(e^{-x}) + \cos(e^{-x})$ **(10)**

OR

Q.1 a) Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \sin^3 x$ **(05)**

b) Solve $\left(D^2+4\right)y = 2\tan 2x$ **(05)**

Q.2 Show that $e^x(x\cos y - y\sin y)$ is a harmonic function. Find the analytic function for which $e^x(x\cos y - y\sin y)$ is imaginary part. **(10)**

OR

Q.2 Apply residue theorem to evaluate $\int_0^{2\pi} \frac{\cos 3\theta}{5-4\cos\theta} d\theta$ **(10)**

Q.3 a) Find the Fourier cosine integral representation for $f(x) = \begin{cases} x^4 & 0<x<a \\ 0 & x>a \end{cases}$ **(05)**

b) Find $z\left(\frac{\sin 2k}{k}\right)$, $k>0$ **(05)**

OR

Q.3 a) Find $z-$transform of $4^k + 3^k$, $k \geq 0$ **(05)**

b) Find the Fourier sine transform of integral x^{k-1} **(05)**

Q.4 a) Solve using Laplace transform $\int_0^\infty e^{-2t} \frac{\sinh t \sin t}{t} dt$ **(05)**

b) Find Laplace transform of $t^3 \cos^3 t$ **(05)**

OR

Q.4 Solve $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = 6e^{-t}$ using Laplace transform, given that $y=-2, \frac{dy}{dt}=8$ at $t=0$ **(10)**

P.T.O.

Q.5 a) Find the value of $\nabla\left(r^n e^{-r}\right)$ **(05)**

b) Find the directional derivative of $e^{2x}\cos(yz)$ at origin in the direction of $i+j+k$. **(05)**

OR

Q.5 Prove that vector field $h(r)\bar{r}$ is always irrotational and determine $h(r)$ such that field is solenoidal. Also find $h(r)$ such that $\nabla^2 h(r)=0$. **(10)**

Q.6 Find the work done in moving a particle once round the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1,\ z=0$ under the field of force given by $\bar{F}=(2x-y+z)\bar{i}+(x+y-z^2)\bar{j}+(3x-2y+z)\bar{k}$ **(10)**

OR

Q.6 If $\bar{F}=(2xy-3z^2)\bar{i}+(4x^2-z)\bar{j}+(y^2+3yz)\bar{k}$, evaluate $\int_C \bar{F}.d\bar{r}$ where C is the curve $x=t,\ y=t^2, z=t^3$ joining the points $(0,0,0)$ and $(1,1,1)$. **(10)**

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