B.Tech. SEM -IV Info. Tech. 2014 Course (CBCS) : SUMMER - 2019
SUBJECT: ENGINEERING MATHEMATICS - III

Day: Thursday
Date: 23/05/2019

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

S-2019-2617

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 $r^2 \frac{d^2u}{dr^2} + r\frac{du}{dr} - u + kr^3 = 0$, where k is a constant. **(10)**
Given that $u=0$ when $r=0$, $u=0$ when $r=a$.

OR

Q.1 a) Solve $(D^2-4D+3)y = 2xe^{3x} + 3e^{3x}\cos 2x$ **(05)**

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

Q.2 Show that the transformation $w = i\frac{(1-z)}{(1+z)}$ transforms the circle $|z|=1$ onto the real axis of the $w-$plane and the interior of the circle into the upper half of the $w-$plane. **(10)**

OR

Q.2 Evaluate $\int_C \frac{(z^2-3z)}{(z+1)^2(z^2+4)}dz$ where C is the circle $|z|=7$ **(10)**

Q.3 Using inverse sine transform find $f(x)$ if $F_s(\lambda) = \frac{e^{-a\lambda}}{\lambda}$ **(10)**

OR

Q.3 a) Find $z-$transform of $3^k \cos(2k+5)$, $k \geq 0$ **(05)**

b) Find the Fourier cosine transform of $f(x) = \begin{cases} \cos x & 0 < x < b \\ 0 & x > b \end{cases}$ **(05)**

Q.4 Use Laplace transform to solve **(10)**

$$\frac{dx}{dt} + y = \sin t,\ \frac{dy}{dt} + x = \cos t \text{ given that } x = 2, y = 0 \text{ at } t = 0$$

OR

Q.4 a) Using Laplace transform, evaluate $\int_0^\infty \frac{\sin t}{t}dt$ **(05)**

b) Find: $L^{-1}\left[\tan^{-1}\left(\frac{2}{s^2}\right)\right]$ **(05)**

P.T.O.

Q.5 a) Prove: **(05)**

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

b) Find the directional derivative of $xy^2 + yz^3$ at the point $(1,-1,1)$ in the direction of $2i - 4j + 2k$. **(05)**

OR

Q.5 a) Show that the vector field given by $\overline{F} = \left(y^2 \cos x + z^2\right)\overline{i} + 2y \sin x\,\overline{j} + 2xz\overline{k}$ is conservative and find scalar field such that $\overline{F} = \nabla\phi$. **(05)**

b) Show that: **(05)**

$$\nabla^2\left(\nabla \cdot \frac{\overline{r}}{r^2}\right) = \frac{2}{r^4}$$

Q.6 Verify Stoke's theorem for $\overline{F} = xy^2\,\overline{i} + y\,\overline{j} + z^2 x\,\overline{k}$ for the surface of rectangular lamina bounded by $x = 0,\ y = 0,\ x = 1,\ \mathrm{y} = 3,\ \mathrm{z} = 0$ **(10)**

OR

Q.6 Verify Green's theorem for the field $\overline{F} = x^2 y\,\overline{i} + xy\,\overline{j}$ over the region R enclosed by $y = x^2$ and line $y = x$. **(10)**

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