

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

Day: Thursday
 Date: 23/05/2019

S-2019-2617

Time: 10.00 AM TO 01.00 PM
 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 $r^2 \frac{d^2u}{dr^2} + r \frac{du}{dr} - u + kr^3 = 0$, 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 (10)
 the real axis of the w -plane and the interior of the circle into the upper half of the w -plane.

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

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

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 $\vec{F} = (y^2 \cos x + z^2)\vec{i} + 2y \sin x \vec{j} + 2xz \vec{k}$ is conservative and find scalar field such that $\vec{F} = \nabla \phi$. (05)

b) Show that: (05)

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

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

OR

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

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