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Total No. of Questions : 09

B.Tech.( Petroleum Refinary Engineering) (2013 Onwards) (Sem.–3)

# ENGINEERING MATHEMATICS-III

Subject Code : BTAM-201

M.Code : 72189

Time : 3 Hrs. Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

## SECTION-A

**1. Write briefly :**

a) Define Fourier series expansion for an even function.

b) Find Fourier sine series of the function $f(x) = 1,\ 0 \le x \le 2$.

c) Find the inverse Laplace transform of $\dfrac{4e^{-(s\pi/2)}}{s^2+16}$

d) Find the Laplace transform of $f(t) = t \sin t$.

e) Obtain a partial differential equation by eliminating the arbitrary constants $c$ and $\omega$ from $z = ce^{\omega t} \cos(\omega x)$

f) State and prove first shifting property of Laplace transforms.

g) Find singular points of the differential equation $(1 - x^2)\, y'' - 2xy' + n\,(n + 1)y = 0$

h) State Cauchy's integral formula.

i) Show that the function $u\,(x, y) = 2x + y^3 - 3x^2y$ is harmonic.

j) Is $f(z) = |z|^2$ analytic function? Justify your answer.

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## SECTION-B

2. Find the solution of the given homogeneous partial differential equation

$$[D^3 - 3D^2D' + 3D(D')^2 + (D')^3]z = 0.$$

3. Show that the function :

$$f(z)=\begin{cases} \dfrac{x^3(1+i)-y^3(1-i)}{x^2+y^2} & z\neq 0, \\ 0 & z=0 \end{cases}$$

satisfies the Cauchy Riemann equations at $z = 0$ but $f'(0)$ does not exist.

4. Evaluate the integral $\oint_C \frac{e^z}{z^2(z+1)^3}dz$, C : $|z| = 2$

5. Find inverse Laplace transform of $\frac{1}{(s^2+9)^2}$

6. Express the Bessel's function $J_4(x)$ in terms of $J_0(x)$ and $J_1(x)$.

## SECTION-C

7. Find series solution about $x = 0$, of the differential equation

$$x(1 + x)y'' + 3xy' + y = 0$$

8. Find all possible Taylor and Laurent series expansions of the function $f(z) = \frac{1}{(z+1)(z+2)^2}$

9. Find the Fourier series expansion of the function :

$$f(x)=\begin{cases} 0 & -\pi \le x \le 0 \\ x^2 & 0 \le x \le \pi \end{cases}$$

and hence show that $1+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}...=\frac{\pi^2}{6}$

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**



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