Printed Pages:02 **Sub Code: AS 201**

Paper Id: 1 9 9 2 0 1 **Roll No.**

B.TECH
(SEM II) THEORY EXAMINATION 2018-19
ENGINEERING MATHEMATICS II

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a. Find the particular integral of $(D^3 - 3D^2 + 5)y = e^{2x}$, where $D \equiv \frac{d}{dx}$

b. Solve the differential equation :$\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 12y = 0$

c. For Bessel's function $J_n(x)$, find the value of $J_{\frac{1}{2}}(x)$.

d. Express x^2 in terms of Legendre's polynomials.

e. Find the Laplace transform of $\sin^2 3t$

f. State first shifting theorem for Laplace transform.

g. Find the Fourier coefficient a_0 for $f(x) = x\cos x; -\pi \le x \le \pi$.

h. Find P.I. of the following partial differential equation:$\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x^2 \partial y} + 4\frac{\partial^3 z}{\partial y^3} = e^{x+2y}$

i. Write the heat equation in one dimension.

j. Classify the following partial differential equation as hyperbolic, parabolic or elliptic: $5\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x \partial t} - 2\frac{\partial^2 u}{\partial t^2} = 0$

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. Solve the following simultaneous differential equations:
$\frac{dx}{dt} + \frac{dy}{dt} + 3x = \sin t$ and $\frac{dx}{dt} + y - x = \cos t$.

b. For Bessel's function $J_n(x)$, prove that $xJ_n'(x) = -n\,J_n(x) + x\,J_{n-1}(x)$

c. Evaluate the following integral using Laplace transform: $\int_0^\infty \frac{e^{-t}\sin\sqrt{3}t}{t}dt$

d. Obtain the Fourier series for the function $f(x) = x^2, -\pi < x < \pi$.

e. Using the method of separation of variables, solve: $\frac{\partial u}{\partial x} = 3\frac{\partial u}{\partial t}$.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) Apply the method of variation of parameters to solve the following differential equation: $\frac{d^2y}{dx^2} + a^2y = \sec ax$

(b) Solve: $(D^2 + D - 2)y = e^x + \cos x$

DR. SHIVANI JOSHI | 04-Jun-2019 09:34:50 | 117.55.242.7

DR. SHIVANI JOSHI | 04-Jun-2019 09:34:50 | 117.55.242.7

4. Attempt any *one* part of the following: **10 x 1 = 10**

(a) Solve $2x(1-x)y'' + (5-7x)y' - 3y = 0$ in series in powers of x.

(b) For Legendre's polynomial $P_n(x)$, prove that $\int_{-1}^{1} P_m(x)P_n(x)dx = 0, m \neq n$

5. Attempt any *one* part of the following: **10 x 1 = 10**

(a) Find the Laplace transform of square wave function of period a defined as:

$$F(t) = \begin{cases} 1 & ,0 < t < \frac{a}{2} \\ -1 & ,\frac{a}{2} < t < a \end{cases}$$

(b) Evaluate by using convolution theorem:$L^{-1}\left\{\frac{p}{(p^2+4)^2}\right\}$

6. Attempt any *one* part of the following: **10 x 1 = 10**

(a) Find the Fourier half range cosine series for the function:

$$f(x) = \begin{cases} 0 & ,0 < x < \frac{\pi}{2} \\ \frac{\pi}{2} & ,\frac{\pi}{2} < x < \pi \end{cases}$$

(b) Find the general solution of $(x^2 - yz)p + (y^2 - zx)q = (z^2 - xy)$ where $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$.

7. Attempt any *one* part of the following: **10 x 1 = 10**

(a) A string is stretched and fastened to two points l apart so that its ends $x = 0$ and $x = l$ are fixed. It is set vibrating by giving each of its points an initial velocity $g(x)$. If the initial displacement of the string is zero, find the deflection $y(x,t)$ of the vibrating string for $t > 0$.

(b) Solve the equation $u_{xx} + u_{yy} = 0$, Given that:
$u(0,y) = u(\pi,y) = 0$ for all y.
$u(x,0) = k, 0 < x < \pi$,
$\lim_{y\to\infty} u(x,y) = 0, 0 < x < \pi$

DR. SHIVANI JOSHI | 04-Jun-2019 09:34:50 | 117.55.242.7

DR. SHIVANI JOSHI | 04-Jun-2019 09:34:50 | 117.55.242.7