Printed Pages:02 **Sub Code: NAS 203**

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B TECH
(SEM- II) THEORY EXAMINATION 2017-18
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 P. I of $(D^2-4)y = x^2$, where $D = \frac{d}{dx}$.

b. Find the first part of C.F in the solution of the differential equation $\frac{d^2y}{dx^2} - \cot x\frac{dy}{dx} - (1-\cot x)y = e^x \sin x$.

c. Express the polynomial $f(x) = x^2 + x + 1$ in terms of Legendre's polynomials.

d. Show that: $J_{1/2}(x) = J_{-1/2}(x)\cot x$.

e. Find the Laplace transform of $\left(\sqrt{t} + \frac{1}{\sqrt{t}}\right)^2$.

f. Find $L^{-1}\left\{\frac{1}{s(p-1)}\right\}$.

g. Expand $f(x) = x$ as a half-range Sine series in $0 < x < 2$.

h. Solve: $2p + q = 3$, where $p = \frac{\partial z}{\partial x}$, $q = \frac{\partial z}{\partial y}$.

i. Classify the partial differential equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial x \partial y} = 0$.

j. Write the one dimensional wave equation.

SECTION B

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

a. Solve: $\frac{d^2x}{dt^2} + y = \sin t$, $\frac{d^2y}{dt^2} + x = \cos t$.

b. Solve in series: $x(x-1)\frac{d^2y}{dx^2} + (3x-1)\frac{dy}{dx} + y = 0$.

c. State convolution theorems for the inverse Laplace transform. Hence or otherwise find the inverse Laplace transform of $\frac{s}{(s^2+a^2)^2}$.

d. Expand the function $f(x) = x\sin x$ as a Fourier series in the interval $-\pi \le x \le \pi$. Deduce that $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \ldots\ldots\ldots\ldots\ldots\ldots = \frac{\pi-2}{4}$.

e. A rod of length l with insulated sides is initially at a uniform temperature u_0. Its ends are suddenly cooled to 0^0C and are kept at that temperature. Find the temperature function $u(x,t)$.

SECTION C

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

(a) By changing the independent variable, solve the differential equation $x\dfrac{d^2y}{dx^2}+(4x^2-1)\dfrac{dy}{dx}+4x^3y=2x^3$.

(b) Solve by the method of variation of parameters: $\dfrac{d^2y}{dx^2}+a^2y=\sec ax$.

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

(a) Prove that: $P_n(x)=\dfrac{1}{2^n n!}\dfrac{d^n(x^2-1)^n}{dx^n}$.

(b) Prove that: $J_{5/2}(x)=\sqrt{\dfrac{2}{\pi x}}\left[\dfrac{(3-x^2)}{x^2}\sin x-\dfrac{3\cos x}{x}\right]$.

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

(a) Draw the graph and find the Laplace transform of the triangular wave function of period $2c$ given by $f(t)=\begin{cases} t, & 0<t\le c \\ 2c-t, & c<t<2c \end{cases}$.

(b) Find the inverse Laplace transform of $\dfrac{s}{(s^2+1)(s^2+4)}$.

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

(a) Obtain a half range cosine series for $\begin{cases} kx, & 0<x<l/2 \\ k(l-x), & l/2\le x\le l \end{cases}$.

Deduce the sum of the series $\dfrac{1}{1^2}+\dfrac{1}{3^2}+\dfrac{1}{5^2}+$......................

(b) Solve the partial differential equation $x(y^2+z)p-y(x^2+z)q=z(x^2-y^2)$, where $p=\dfrac{\partial z}{\partial x}$, $q=\dfrac{\partial z}{\partial y}$.

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

(a) Use the method of separation of variable to solve the equation $\dfrac{\partial u}{\partial x}=2\dfrac{\partial u}{\partial t}+u$, given that $u(x,0)=6e^{-3x}$.

(b) An infinitely long plane uniform plate is bounded by two parallel edges and end at right angles to them. The breadth is π. This end is maintained at temperature u_0 at all points and the other edges are kept at zero temperature. Determine the temperature at any point of the plate in steady state.