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B. TECH.
(SEM II) THEORY EXAMINATION 2018-19
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 order and degree of the differential equation $\frac{d^4y}{dx^4}+3\left(\frac{dy}{dx}\right)+5y=0$.
b. Solve $the\ differential\ equation\ y_2-5y_1+6=0$.
c. Express $J_{3/2}(x)$ in terms of sin and cos.
d. Express $f(x)=1-3x+3x^2$ in terms of Legendre's polynomials.
e. Find the $L[e^{at}sinat]$.
f. Find the inverse Laplace f (t) of $\frac{8s}{s^2+16}$.
g. Solve P.D.E.25r – 40s + 16t=0.
h. What are the applications of Fourier series?
i. Write the two dimensional wave equations.
j. Write the two dimensional heat equations in steady state.

SECTION B

2. Attempt any *three* of the following: 10x3=30

a. Solve the differential equation by the method of variation of parameters $(D^2+1)y=xcos2x$.
b. Solve in series :$x^2\frac{d^2y}{dx^2}+x(x-1)\frac{dy}{dx}+(1-x)y=0$
c. Solve the D.E. using Laplace transform: $(D^2-2D-8)y=0, y(0)=3, \frac{dy}{dx}=6\ at\ x=0$.
d. Solve the P.D.E.$\left(D_x^2+D_xD_y-6D_y^2\right)z=x^2\sin(x+y)$.
e. Find the temperature in a bar of length 2 whose ends are kept at zero and lateral surface insulated if the initial temperature is $\left(sin\frac{\pi x}{2}+3sin\frac{5\pi x}{2}\right)$.

SECTION C

3. Attempt any *one* part of the following:

a. Solve the differential equation:$(D^2-1)y=xsinx+x^2e^x$.
b. Solve the differential equation:$(x^3D^3+3x^2D^2+xD+1)y=x+logx$.

4. Attempt any *one* part of the following:

a. State and prove Orthogonality of Bessel's Functions.
b. Express x^5 in terms of Legendre polynomials.

5. Attempt any *one* part of the following:

a. Find the Laplace transform of the functions $(t) = \frac{cosat - cosbt}{t}$.

b. Use the convolution theorem to find the inverse Laplace transform of $\frac{1}{s^2(s^2+1)}$.

6. Attempt any *one* part of the following:

a. Obtain the Fourier series expansion of $(x) = e^{ax}\ in\ (0,2\pi)$.

b. Obtain the Fourier series expansion of $f(x) = \frac{\pi - x}{2}\ in\ 0 < x < 2$.

7. Attempt any *one* part of the following:

a. A string of length L is stretched and fastened to two fixed points. Find the solution of the wave equation $y_{tt} = a^2 y_{xx}$ when intial displacement $(x, 0) = f(x) = bsin\left(\frac{\pi x}{L}\right)$.

b. Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ in a rectangle in the xy plane $0 < x < a\ and\ 0 < y < b\ such\ that\ u(x, o) = 0, u(x, b) = 0, u(0, y) = 0, u(a, y) = f(y)$.