Subject Code: RAS203

PAPER ID-421694

Roll No:

BTECH
(SEM II) THEORY EXAMINATION 2021-22
ENGINEERING MATHS-II

Time: 3 Hours *Total Marks: 70*

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

SECTION A

1. Attempt *all* questions in brief. **2*7 = 14**

a.	Calculate order and degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^{3/2} = k\frac{d^2y}{dx^2}$.
b.	Find particular integral of $(D-2)^2y = 8e^{2x}$.
c.	Prove that $J_0{}'(x) = -J_1(x)$.
d.	Evaluate $\int_{-1}^{1} x^2P_2(x)dx$.
e.	Find the Laplace transform of $F(t) = e^t t^{-1/2}$.
f.	Find the function whose Laplace transform is $\frac{e^{-\pi s}}{s^2+2}$.
g.	Find the Fourier constant a_n for $f(x) = x\cos x$ in the interval $(-\pi, \pi)$.

SECTION B

2. Attempt any *three* of the following: **7*3 = 21**

a.	Solve by changing independent variable the differential equation $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 4\cos\log(1+x)$.
b.	Use Frobenius method to find the series solution of $2x(1-x)\frac{d^2y}{dx^2} + (5-7x)\frac{dy}{dx} - 3y = 0$.
c.	State Convolution Theorem and hence evaluate $L^{-1}\left[\frac{s}{(s^2+1)(s^2+4)}\right]$.
d.	Obtain Fourier series for $f(x) = \begin{cases} \pi x, & 0 \le x \le 1 \\ \pi(2-x), & 1 \le x \le 2 \end{cases}$.
e.	If a string of length l is initially at rest in equilibrium position and each of its point is given the velocity $\left(\frac{\partial y}{\partial t}\right)_{t=0} = b\sin^3\frac{\pi x}{l}$, find the displacement $y(x,t)$.

SECTION C

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

a.	Solve the following simultaneous differential equations $\frac{dx}{dt} = 3x + 2y, \frac{dy}{dt} = 5x + 3y$
b.	Solve the differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = \frac{e^{-x}}{x+2}$.

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

a.	Express $F(x) = x^3 - 5x^2 + x + 2$ in terms of Legendre's polynomials.
b.	Prove that $J_{3/2}(x) = \sqrt{\frac{2}{\pi x}}\left(\frac{\sin x}{x} - \cos x\right)$.

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

a.	Find the Laplace transform of the rectified semi-wave function defined by $f(t) = \begin{cases} \sin wt, & 0 < t \leq \frac{\pi}{w} \\ 0, & \frac{\pi}{w} < t < \frac{2\pi}{w} \end{cases}$
b.	Using Laplace transform, evaluate the integral $\int_0^\infty \frac{e^{-2t} - e^{-4t}}{t} dt$

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

a.	Obtain the Fourier series for the function $f(x) = x\sin x, 0 < x < 2\pi$.
b.	Solve the linear partial differential equation $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} = \sin(2x + 3y)$.

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

a.	Use the method of separation of variables to solve the equation $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, given that $u(x, 0) = 6e^{-3x}$.
b.	The temperature distribution in a bar of length π which is perfectly insulated at ends $x = 0$ and $x = \pi$ is governed by partial differential equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$. Assuming the initial temperature distribution as $u(x, 0) = f(x) = \cos 2x$. Find the temperature distribution at any instant of time.