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BTECH
(SEM II) THEORY EXAMINATION 2021-22
ENGG MATHematics-II

Time: 3 Hours

Total Marks: 100

Notes:

- Attempt all sections and assume any missing data.
- Appropriate marks are allotted for each question, answer accordingly.

SECTION-A Attempt ALL of the following Questions in brief		marks(10X2=20)
Q21(a)	Find the particular integral of $(D^2 - 4D + 4)y = x^2$, where $D = \frac{d}{dx}$.	
Q21(b)	Find the order and degree of the following differential equation $\frac{d^2y}{dx^2} + \sqrt{1 + \left(\frac{dy}{dx}\right)^2} = 0$	
Q21(c)	For a Legendre polynomial prove that $P_n(1) = 1$ and $P_n(-1) = (-1)^n$.	
Q21(d)	Write the Dirichlet's conditions for Fourier series.	
Q21(e)	Prove that $L[e^{at} f(t)] = F(x - a)$.	
Q21(f)	Write the two dimensional wave equations.	
Q21(g)	Find the inverse Laplace transform of $\frac{x}{x^2 - 9}$	
Q21(h)	Find the value of the Fourier coefficient a_1 for the function $f(x) = \begin{cases} 0, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$	
Q21(i)	Classify the following partial differential equation along the line $y = x$: $y u_{xx} + (x + y) u_{xy} + x u_{yy} = 0$	
Q21(j)	Show that $P_n(x) = P_n(-x)$ for n odd.	
SECTION-B Attempt ANY THREE of the following Questions		marks(3X10=30)
Q21(a)	Solve the following simultaneous differential equations $\frac{d^2x}{dt^2} + y = \sin t, \quad \frac{d^2y}{dt^2} + x = \cos t.$	
Q21(b)	Obtain the Fourier series to represent $f(x) = \frac{1}{2}(\pi - x)^2$ in the interval $0 \leq x \leq 2\pi$. Hence deduce that $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}$	
Q21(c)	Find the series solution for the differential equation $(3 - x^2)y'' - 2xy' + 20y = 0$.	
Q21(d)	State Convolution theorem for IFT versus Laplace transforms and hence evaluate $L^{-1} \left\{ \frac{1}{(s^2 - a^2)^2} \right\}$.	
Q21(e)	A lightly stretched string with fixed end $x=0$ and $x=l$ is initially in a position given by $y = a \sin \frac{\pi x}{l}$. If it is released from rest this position, find the displacement $y(x, t)$.	
SECTION-C Attempt ANY ONE following Question		marks(1X10=10)
Q21(a)	Solve by the method of variation of parameters: $\frac{d^2y}{dx^2} + 4y = \tan 2x$	