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Jaypee University of Information Technology, Waknaghat

TEST-3 Examination - May 2026

B.Tech. II Semester (CSE/IT/CSECS/FSSD/AIDS/AIML/UXUI)

Course Code(Credits): 18B11MA211(4) Max. Marks: 35
Course Title: Engineering Mathematics–II
Course Instructors: RAD, RKB, NKT, PKP, MDS Max. Time: 2 Hours

Note: (a) ALL questions are compulsory.

(b) Use of calculator is NOT allowed.

(c) The candidate is allowed to make suitable numeric assumptions wherever required.

Q.No	Question	CO	Marks
Q1	Answer the following questions: (a) Obtain the general solution of $(2D^3 + 3D^2 - D - 2)y = 0$. (b) Test the convergence of $1+\frac{3}{7}x+\frac{3\cdot6}{7\cdot10}x^2+\frac{3\cdot6\cdot9}{7\cdot10\cdot13}x^3+\cdots \quad (x>0)$	CO-2	[4+3]
Q2	Solve the following problems: (a) Find the Fourier series of $f(x)$ having period 2π in $(-\pi,\pi)$: $f(x) = \begin{cases} -1, & -\pi < x < -\frac{\pi}{2}, \\ 0, & -\frac{\pi}{2} < x < \frac{\pi}{2}, \\ 1, & \frac{\pi}{2} < x < \pi. \end{cases}$ (b) For the Bessel function $J_n(x)$, show that $J_{-\frac{5}{2}}(x) = \sqrt{\frac{2}{\pi x}}\left[\frac{3}{x}\sin x + \left(\frac{3-x^2}{x^2}\right)\cos x\right]$.	CO-3,4	[4+3]
Q3	Show the following: (a) Prove that the half-range series for $f(x) = x$ in $0 < x < \pi$ is $x = \frac{\pi}{2} - \frac{4}{\pi}\left(\frac{\cos x}{1^2} + \frac{\cos 3x}{3^2} + \frac{\cos 5x}{5^2} + \cdots\right)$. (b) State Parseval's identity and deduce $\frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \cdots = \frac{\pi^4}{96}$.	CO-4	[4+3]

Q.No	Question	CO	Marks
Q4	Attempt the following questions: (a) A thin, homogeneous rod of length π meters is perfectly insulated along its lateral surface, so that heat transfer takes place only in the longitudinal direction. The ends of the rod are maintained at zero temperature for all time. If $u(x,t)$ denotes the temperature at position $x \in (0,\pi)$ and time $t > 0$, then the temperature distribution is governed by the one-dimensional heat equation: $$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, \qquad 0 < x < \pi, \qquad t > 0.$$ With the initial condition: $$u(x,0) = \sin x + \sin 2x, \qquad 0 \le x \le \pi.$$ Solve the given initial boundary value problem. (b) Classify the following second-order partial differential equation as parabolic, elliptic, or hyperbolic in the second quadrant of the xy-plane: $$\left(\sqrt{x^2+y^2}\right)\frac{\partial^2 u}{\partial x^2} + 2(x-y)\frac{\partial^2 u}{\partial x \partial y} + \left(\sqrt{x^2+y^2}\right)\frac{\partial^2 u}{\partial y^2} = 0.$$	CO-4	[5+2]
Q5	Answer the following questions: (a) Find $f'(z)$ at $z \neq 0$ for $f(z) = 5x - 2y + i(2x+5y)$. (b) Verify that $f(z) = e^x(\cos y + i \sin y)$ satisfies CR equations. (c) Evaluate the integral $$\oint_C \frac{z^3 - 2z + 1}{(z-i)^2}\, dz, \qquad \text{where } C : |z| = 2,$$ using Cauchy Integral Formula.	CO-5	[2+2+3]

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