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Jaypee University of Information Technology, Waknaghat

TEST-2 Examination - March 2026

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

Course Code(Credits): 25B11MA211/24B11MA211/18B11MA211(4) Max. Marks: 25
Course Title: Mathematics–II/Engineering Mathematics–II
Course Instructors: RAD,RKB,NKT,PKP,MDS Max. Time: 1 Hour 30 Min

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	(a) Consider $x^2y'' - 2xy' + 2y = 4x^3$. Using the transformation $x = e^t$, reduce the given differential equation to a linear differential equation with constant coefficients and hence obtain its general solution. (b) During training of a machine-learning model, parameter updates gradually become smaller as the algorithm approaches an optimum. Suppose the normalized cost at iteration n is given by $a_n = \frac{5+\sqrt{n^2+4n}}{n^3+1}$. Using the *limit comparison test*, determine whether the total cumulative cost $$\sum_{n=0}^{\infty} a_n$$ is convergent (i.e., finite) or divergent.	CO-1,2	[3+2]
Q2	In numerical simulations, solutions of differential equations are approximated using power series. Consider $(1+x^2)y'' + xy' - y = 0$. (a) Assume a power series solution $y = \sum_{n=0}^{\infty} a_n x^n$ about $x = 0$. Find the recurrence relation for the coefficients. (b) Obtain the series solution up to the term containing x^4.	CO-3	[3+2]
Q3	Consider the differential equation: $$(x - x^2)\frac{d^2y}{dx^2} + (1-5x)\frac{dy}{dx} - 4y = 0.$$ (a) Determine the *indicial equation* and obtain its roots. (b) Using Frobenius method about $x = 0$, determine the coefficients a_1, a_2 interms of a_0 for the first solution $y_1(x)$.	CO-3	[3+2]

Q.No	Question	CO	Marks
Q4	Prove the following identities for Bessel functions of the first kind: (a) $\frac{d}{dx}\left[x^{-n}J_n(x)\right] = -x^{-n}J_{n+1}(x)$ (b) $\int J_3(x)\,dx = -J_2(x) - \frac{2}{x}J_1(x) + c$	CO-3	[3+2]
Q5	For Legendre polynomials $P_n(x)$, prove and express the following: (a) Prove that $nP_n(x) = (2n-1)xP_{n-1}(x) - (n-1)P_{n-2}(x)$. (b) Express $5x^3 - 6x^2 - 7$ in terms of $P_0(x), P_1(x), P_2(x), P_3(x)$.	CO-3	[3+2]

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