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(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test - March 2023

Programme	: B.Tech.	Semester	: Win 2022-23
Course	: Differential Equations and Transforms	Code	: BMAT102L
		Slot	: A1+TA1+TAA1
I	: Dr. Soumendu, Dr. Hannah, Dr. Radha, Dr. Abhishek, Dr. David, Dr. P. Vijay Kumar, Dr. Sowndarrajan	Class ID	: CH2022231000429,430, 433, 434, 438, 436, 439
Time	: 90 Minutes	Max.Marks	: 50

Answer ALL the questions

1. Find the particular solution using the method of undetermined coefficients for [5]

$$y'' + y' - 2y = e^t \sin t$$

where $y_c = c_1 e^{-2t} + c_2 e^t$.

2. Solve: $y'' + \dfrac{1}{x} y' = \dfrac{12 \log x}{x^2}$ [10]

3. (a) Form a partial differential equation by eliminating arbitrary function f from [5]

$$f(xyz, x + y + z) = 0.$$

(b) Find the complete solution of $p^3 + q^3 - 3pqz = 0$ [5]

4. (a) Find the singular solution of [5]

$$px + qy - z + (2p^2 + 3q^2 + 1)^{1/2} = 0.$$

(b) Solve: $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$. [5]

5. Consider a mass on a spring with the equation $mx'' + cx' + kx = F(t)$ with mass 0.5, $c = 8$ is the friction and k, the spring constant is zero, and $F(t) = 10\cos(\pi t)$ is an external force acting on the mass with initial conditions $x(0) = 0$ and $x'(0) = 0$ [10]

6. Find the Laplace transform of $f(t) = \sin 2t \cos t \cosh 2t$ [5]

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Continuous Assessment Test I – March 2023

Programme	B.Tech.	Semester	Winter 2022-2023
Course Title	Differential Equations and Transforms	Code	BMAT 102L
		Slot	A2-TA2
Faculty	Dr. Saroj Kumar Dash, Dr. Lakshmanan Shanmugham, Dr. Abhishek Kumar Singh, Dr. Harshavardhini Shanmugam, Dr. P.T. Sowndarrajan, Dr. Soumendu Roy, Dr. Manimaran J.	Class No	CH2022232300442, CH2022232300445, CH2022232300446, CH2022232300447, CH2022232300448, CH2022232300449, CH2022232300450
Time	90 Minutes	Max. Marks	50

Answer ALL the Questions (5x10 = 50)

Q.No.	Sub Sec.	Question Description	Marks
1.		Solve the ordinary differential equation by using method of undetermined coefficients: $$y'' - 4y' - 12y = 3e^{5t} + \sin 2t + te^{4t}.$$	10
2.		A 2 kg mass is attached to a vertically hanged spring, which the spring elongated 61.25 cm below its original length. Suppose the spring-mass sytem is inside a damping medium with damping constant 8 units. Find the displacement $x(t)$ at any time t, if we start the experiment by releasing the mass from the position 2 cm above its equilibrium position. [**Note:** g = 9.8 units (in MKS system) and 980 units (in CGS system).]	10
3.	a)	Solve the ordinary differential equation: $$x^2y'' + xy' + y = \sin(\ln x^2).$$	5
	b)	Form the PDE by eliminating the arbitrary function $$F(xy + z^2, x + y + z) = 0.$$	5
4	a)	Solve the following PDE by the method of separation of variables. $\frac{\partial u}{\partial x} = 4\frac{\partial u}{\partial y}$, given that, $u(0, y) = 8e^{-3y}$.	5
	b)	Solve: $x^2(y^2 - z^2)p + y^2(z^2 - x^2)q = z^2(x^2 - y^2)$.	5
5.	a)	Find the complete solution/integral of: $z = px + qy + \sqrt{1 + p^2 + q^2}$. And hence find the singular solution/integral if it exists.	
	b)	Find $$L\left[t^{\frac{3}{2}} + 5t^3 + 7te^{-2t}\right]$$	

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Continuous Assessment Test I – March 2023

Programme	: B.Tech.	Semester	: WIN SEM 2022-23
Course Title	: Differential Equations and Transforms	Code	: BMAT102L
		Slot	: C1+TC1+TCC1
Faculty(s)	: Dr. Saroj Kumar Dash; Dr. Srutha Keerthi B; Dr. Somnath Bera; Dr. Ashish Bera; Dr. Kriti Arya	Class Nos.	CH2022232300616; CH2022232300617; CH2022232300673; CH2022232300618; CH2022232300682
Time	: 90 Minutes	Max. Marks	: 50

Answer ALL the Questions

Q.No.	Question Description	Marks
1.	Solve the following differential equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} = x + e^x \sin x$ by the method of undetermined coefficients.	10
2.	A mass weighing 32 Pounds attached to a vertically hanged spring, by which the spring elongated 3.2 Feet below its original length. Suppose the spring-mass system is inside a damping medium with the damping constant one 5th of the spring constant. Find the displacement $x(t)$, if the mass is released 3 Feet below the equilibrium position with an upward velocity of 5 Feet/Sec. [**Note:** $g = 32$ units (in FPS system).]	10
3.	(a) Form the partial differential equation by eliminating the arbitrary functions $f(x, y)$ and $\phi(x, y)$ from $z = f(x^3 + 2y) + g(x^3 - 2y)$. (b) Find the singular solution for the partial differential equation $z = px + qy + 3p^{\frac{1}{3}}q^{\frac{1}{3}}$.	5+5
4.	Solve the following PDE: $x(y^2 + z)p - y(x^2 + z)q = z(x^2 - y^2)$.	10
5.	(a) Find the particular solution of the ordinary differential equation: $2x^2y'' + 5xy' + y = \left(\frac{1}{2}\right)\left(1 - \frac{1}{x}\right)$, if the complementary solution/homogeneous solution is: $y_h(x) = y_c(x) = c_1x^{-1/2} + c_2x^{-1}$ by using a method except using the Operator method. (b) Using standard formulae, derive the Laplace transform of the following function $\sin^2 t \cos t$.	5+5

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Continuous Assessment Test (CAT)-I - March 2023

Programme	:	B.Tech.	Semester	:	Winter Semester 1 year 2022-2023
Course Title	:	Differential Equations and Transforms	Code		BMAT102L
			Slot		C2+TC2+TCC2
Faculty	:	Dr. A. Berin Greeni, Dr. G.K. Revathi, Dr. Sandip Saha, Dr. Saurabh Chandra Maury, Dr. Ankit Kumar, Dr. Karan Kumar Pradhan	Class Id		CH2022232300619, CH2022232300675, CH2022232300679, CH2022232300620, CH2022232300621, CH2022232300677.
Duration	:	90 minutes	Max. Marks	:	50

Answer all the Questions (50 marks)

Q. No.	Question Description	Marks
1.	Solve $(1+2x)^2y'' - 6(1+2x)y' + 16y = 8(1+2x)^2$ using the method of variation of parameters.	[10]
2.	Find the charge on the capacitor in an RLC series circuit $L = 1$ henry, $C = 10^{-4}$ farad, $R = 100$ ohms, $E = 100$ volts. Assume the initial charge on the capacitor is 0 C and no current is flowing at time $t = 0$.	[10]
3.	Solve the nonlinear partial differential equation $\sqrt{p}\,(x\sqrt{p}+1) + \sqrt{q}\,(y\sqrt{q}-1) = z$ and hence find the singular integral (if exists!).	[10
4.	A) Obtain the partial differential equation associated with $x^2 + y^2 = (z-c)^2\tan^2\alpha$, where c and α are arbitrary constants and then the PDE for any arbitrary surface $z = f(x^2+y^2)$. Compare the PDE obtained for these surfaces. B) Find the integral surface of the following linear partial differential equation $x(y^2 - z)p - y(x^2 - z)q = (x^2 - y^2)z$	[5-
5.	A) Solve $y'' + y' = 1 - 2x^2$ using the method of undetermined coefficient. B) Find the Laplace transform of $f(t) = e^{2t}\cos^2 t$.	[

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22BRS1033

Continuous Assessment Test I - March 2023

Programme	: B.Tech.	Semester	: Winter Semester I year 2022-23
Course	: Differential Equations and Transforms	Code	: BMAT102L
		Slot	: D1+TD1+TDD1
Faculty	: Dr. Radha, Dr. Nathiya, Dr. Harshavarthini, Dr. David Raj, Dr. Ashish Kumar, Dr. Karan Kumar Pradhan, Dr. Manoj Kumar Singh, Dr. Prosenjit Paul, Dr. Abhishek Kumar Singh, Dr. Sandip Saha, Dr. Revathi, Dr. Vijay Kumar, Dr. Berin Greeni	Class ID	: CH2022232300591, 594, 595, 622, 627, 629, 630, 628, 593, 631, 590, 634, 680, 592
Time	: 90 Minutes	Max.Marks	: 50

Answer ALL the questions ($5 \times 10 = 50$ marks)

1. Find the singular integral of $(p+q)(z-px-qy)=1$. [10]

2. (a) Find the complete solution of $q = py + p^2$. [3]

   (b) Solve the following PDE using separation of variables method $\frac{\partial z}{\partial x} + 4z = \frac{\partial z}{\partial t}$, given that $z(x,0) = 4e^{-3x}$. [7]

3. Find the Laplace transformation of the following:

   (a) $f(t) = e^{3t}(\cosh t + \sin^2 t)$ [5]

   (b) $f(t) = \sqrt{t} - \frac{(\sqrt{t})^3}{3!} + \frac{(\sqrt{t})^5}{5!}$ [5]

4. Solve the following differential equation $x^2y'' + 5xy' + 4y = x\log x$. [10]

5. (a) Solve the following differential equation by the method of undetermined coefficients $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^x$. [5]

   (b) An electric circuit consists of an inductance $L = 2H$, a resistance $R = 14\Omega$ and a condenser of capacitance of $C = 0.05F$. Find the charge $q(t)$ and current $i(t)$ at any time t. Given that $q(0) = 1$ and $i(0) = 4$. [5]