

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Backlog), November 2018

B. Tech.(All Branches), Semester II

Roll No.....

COURSE CODE: MA 201

Time: 3 hours

Max. Marks: 100

COURSE TITLE: Engineering Mathematics II

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Calculators are allowed.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. An auxiliary equation of an ordinary differential equation gives the
 - (a) particular solution
 - (b) particular integral
 - (c) complete solution
 - (d) singular solution
- ii. The dimension of the vector space $W = \{(a, b, c, t) : a, b, c, t \in \mathbb{R}\}$ is
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
- iii. The vectors $(1, 2, 0)$, $(-1, 1, 2)$ and $(3, 0, -4)$ are
 - (a) Linearly dependent
 - (b) Linearly independent
 - (c) both
 - (d) none of these
- iv. The PDE $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ is
 - (a) Elliptic
 - (b) Parabolic
 - (c) Hyperbolic
 - (d) none of these
- v. In the following LPP, which are the basic variables
 $Max. Z = x_1 + x_2 + x_3 + x_4 + x_5$
subject to $x_1 + x_2 - 2x_3 + x_4 = 10$
 $4x_1 + x_2 + x_3 + x_5 - x_6 = 20$
and $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0, x_4 \geq 0, x_5 \geq 0, x_6 \geq 0$
 - (a) x_1 and x_2
 - (b) x_3 and x_4
 - (c) x_4 and x_5
 - (d) none of these
- vi. If a vector space V is defined by $V = \{(x, y, y) : x, y \in \mathbb{R}\}$, then the dimension of vector space V is
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) none of these
- vii. The integrating factor for the ODE $y dx + 2x dy = 0$ is
 - (a) $\frac{1}{xy}$
 - (b) $\frac{1}{3xy}$
 - (c) $\frac{-1}{xy}$
 - (d) $\frac{-1}{3xy}$
- viii. Which ONE of the following is a linear non-homogeneous differential equation, where x and y are the independent and dependent variables respectively?

- (a) $\frac{dy}{dx} + xy = 0$ (b) $\frac{dy}{dx} + xy = e^{-x}$ (c) $\frac{dy}{dx} + xy = e^{-y}$ (d) none of these
- ix The differential equation $\frac{d^2y}{dx^2} + x^2 \frac{dy}{dx} + x^3 y = e^x$ is a
 (a) non-linear differential equation of first degree
 (b) linear differential equation of first degree
 (c) linear differential equation of second degree
 (d) non-linear differential equation of second degree
- x $Mdx + Ndy = 0$ is an exact differential equation if
 (a) $M=N$ (b) $\frac{\partial M}{\partial x} = \frac{\partial N}{\partial x}$ (c) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial y}$ (d) none of these

Q.2 Short answer type questions (4 questions @ 2.5 marks)

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- (i) Find the P.I. of $(D^2 - 9)y = \sinh x$
- (ii) What is meant by linear and non-linear in relation to ordinary differential equations?
- (iii) Define a Linear Mapping. Show whether the mapping $G: R^2 \rightarrow R^2$ defined by $G(x, y) = (x+1, y+2)$ is a linear map or not.
- (iv) Solve $(1+e^x) y dy = (1+y) e^x dx$

Q.3A Solve the following ODE by method of variation of parameters

05

$$(D^2 - 1)y = \frac{1}{1+e^x}$$

Q.3B

05

Find the eigen values of $A = \begin{bmatrix} 2 & 1 & -1 \\ 3 & 2 & -3 \\ 3 & 1 & -2 \end{bmatrix}$.

Q.4A Solve the following LPP using Graphical method

05

Max $Z = 4X_1 + 9X_2$
 s.t. $X_1 + 5X_2 \leq 200$
 $2X_1 + 3X_2 \leq 134$
 and $X_1 \geq 0, X_2 \geq 0$

Q.4B Find the complete solution of the second order ODE

05

$$(D^2 + 2)y = xe^{3x} + e^x \sin x.$$

Q.5A

05

Find the eigen values and eigen vectors of $A = \begin{bmatrix} 2 & 1 & -1 \\ 3 & 2 & -3 \\ 3 & 1 & -2 \end{bmatrix}$.

Q.5B Define a spanning set and dimension of a vector space. Consider a vector space $V = R^3$. Check whether the vectors $\langle 1, 1, 1 \rangle$, $\langle 0, 2, 3 \rangle$ and $\langle 1, 5, 8 \rangle$ forms a basis for V or not. If possible, express the vector $\langle 1, 2, 3 \rangle$ as a linear combination of above mentioned vectors.

05

Q.6A A firm uses kaplane machines, francis machines and lathes to produce two motor

05

part: The machine times req. for each part, the machine times available on different machines and the profit on each motor part are given below

Type of machine	Machining time req for the motor part (mts)		Max time avail. Per week (min)
	I	II	
kaplane machines	10	4	\$100
francis machines	3	2	\$700
Lathes	6	12	\$1000
Profit / unit (rs)	100	40	

Determine no. of the parts I and II to be manufactured per week to max the profit

Q.6B Show that the equations $2x+6y=-11$, $6x+20y-6z=-3$, $6y-18z=-1$ are not consistent. 05

OR

Q.6B Solve the ODE $(D^2 + 1)y = \sec x$. 05

Q.7A Solve the following system of linear equations using matrix method or elementary row transformation. 05

$$2x+4y-6z=-4, x+5y+3z=10, x+3y+2z=5$$

Q.7B Solve the following PDE using Charpit's method 05

$$p = (qy + z)^2.$$

OR

Q.7B Solve the following ordinary differential equations using series solution method 05

$$y'' + xy' + x^2y=0$$

Q.8A Solve the heat equation $k \frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$, $0 < x < 2, t > 0$ subject to the given conditions: 10

$$u(0, t) = 0; u(2, t) = 0; u(x, 0) = \begin{cases} 1, & 0 < x < 1 \\ 0, & 1 < x < 2 \end{cases}$$

Q.9A 10

$$A = \begin{bmatrix} 5 & -1 & 5 \\ 0 & 2 & 0 \\ -5 & 3 & -15 \end{bmatrix}$$

State and verify Caley Hamilton theorem for the inverse of A. and hence find

Q.9B Solve the following LPP by Simplex method

$$\text{Maximize } Z = 60x + 15y$$

$$\text{subject to } x + y \leq 60$$

$$3x + y \leq 90$$

$$\text{and } x \geq 0, y \geq 0$$

10

OR

Q.9B (a) $\cos x \, dy = y(\sin x - y)dx$

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(b) Find the solution of electric circuit equation with and inductance 'L' henries:

$$\frac{d^2x}{dt^2} + \frac{g}{l}x = \frac{g}{l}L \text{ where } g, l, L \text{ are constants subject to the condition } x=a, \frac{dx}{dt} = 0 \text{ at } t=0.$$