

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Special Backlog), November 2016

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. Assume suitable data wherever required and mention it clearly.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
i.	The matrix $A = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ is a form of ; (a) Upper triangular matrix (b) Scalar matrix (c) Unit matrix (d) Lower triangular matrix	
ii.	The $Mdx + Ndy$ is called exact, if; (a) $\frac{\partial M}{\partial x} = \frac{\partial N}{\partial y}$ (b) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ (c) $M = f(y)$ (d) $N = f(x)$	
iii.	Degree of a differential equation is; (a) power of highest order derivative (b) order of highest order derivative (c) power of lowest order derivative (d) order of lowest order derivative	
iv.	The intersection of any two subspaces of a vector space V over F ; (a) is a subspace (b) need not be a subspace (c) not a subspace (d) is a field	
v.	The rank of a null matrix is; (a) 1 (b) 0 (c) can't determine (d) none of these	
vi.	The one-dimensional wave equation is (a) $\frac{\partial^2 u}{\partial t^2} = \frac{\partial u}{\partial x}$ (b) $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ (c) $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ (d) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$	
vii.	All possible solutions of a LP model are called; (a) Basic solutions (b) Basic feasible solutions (c) Feasible solutions (d) Optimal solution	
viii.	The general solution of $\frac{d^2 y}{dx^2} - y = 0$ is (a) $y = P \cos x + Q \sin x$ (b) $y = P \cos x$ (c) $y = Q \sin x$ (d) None of theses	
ix.	If $AX = 0$ is consistent, it will have trivial solution if; (a) $\text{rank}(A) = \text{Order of } A$ (b) $\text{rank}(A) > \text{Order of } A$ (c) $\text{rank}(A) < \text{Order of } A$ (d) $\text{rank}(A) \neq \text{Order of } A$	
x.	$u_{xx} + u_{yy} = 0$ is a; (a) two-dimensional Laplace equation (b) partial differential equation (c) ordinary differential equation (d) (a) and (b) both	

Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
Q.2A	Write any three engineering applications of differential equations.	
Q.2B	Explain the difference between slack and surplus variables and write down the popular methods that are used to solve in the case of occurrences of such variables in various cases.	
Q.2C	Write down the condition of consistency of system of equations $AX = B$ along with nature of solutions in different cases.	
Q.2D	Prove that the vectors $V_1 (1, 3, 2)$, $V_2 (1, -7, -8)$ and $V_3 (2, 1, -1)$ are linear dependent.	
Q.3A	Solve PDE: $px + qy = pq$ using charpit method.	05
Q.3B	Solve: $(x^2 - 2xy)dy + (x^2 - 3xy + 2y^2)dx = 0$	05
Q.4A	Find the rank of $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 3 & 2 & 1 \end{bmatrix}$.	05
Q.4B	Solve the ODE $x^2 y'' - 3xy' + 3y = 0$ with $y(1)=0$, $y'(1)=-2$.	05
Q.5A	Find the Eigen values and Eigen vectors of a matrix $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$.	05
Q.5B	Reduce $S = \{(1, 0, 0), (0, 1, -1), (0, 4, -3), (0, 2, 0)\}$ to obtain a basis of $\mathbb{R}^3$.	05
Q.6A	Solve the following ODE by method of variation of parameters $(D^2 - 1)y = \frac{1}{1 + e^x}$	05
Q.6B	Solve: $(1 + x^2) \frac{dy}{dx} + y = e^{\tan^{-1} x}$	05
Q.7A	Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$. Hence compute A^{-1} .	10
Q.7B	A factory manufactures nails and screws. The profit earned is Rs. 2/Kg nails and Rs. 3/Kg screws. Three units of labours are required to manufacture 1 Kg. nails and 6 units to make 1 Kg. screws. Twenty four units of labour are available. Two units of raw materials are needed to make 1 Kg. nails and 1 unit for 1 Kg. screws. Using graphical method, determine the manufacturing policy that yields maximum profit from 10 units of raw materials.	10
OR		
Q.7B	Solve the vibrating-string problem $\frac{\partial^2 u}{\partial t^2} = c \frac{\partial^2 u}{\partial x^2}$ with the conditions $u(0,t)=0=u(l,t)$ $u(x,0) = \begin{cases} x & \text{if } 0 < x < l/2 \\ (l-x) & \text{if } l/2 < x < l \end{cases}$ and $u_t(x,0) = x(x-l); 0 < x < l$	10
Q.8A	Use simplex method to solve the following LPP $Max Z = x + y$; Subject to $-x + y \leq 1$; $x - 2y \leq 4$ and $x, y \geq 0$	10
Q.8B	Find the general solution of ODE $(D^2 + 1)y = e^{2x} \sin 3x$	10
OR		
Q.8B	Solve the ODE: $xy'' + y' + 2y = 0$ using power series method about $x = 0$.	10