



MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : M-201

MATHEMATICS-II

Time Allotted: 3 Hours

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Full Marks: 70

The figures in the margin indicate full marks

*Candidates are required to give their answers in their own words
as far as practicable.*

Answer as per instructions.

Group – A

(Multiple Choice Type Questions)

I. Choose the correct alternatives for any ten of the following (10×10=100)

(i) In the differential equation $M dx + N dy = 0$ if $\frac{1}{y} \left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} \right) = \frac{-a}{x}$ then the integrating factor is

(a) x^{-a}

(b) x^{-2}

(c) a^x

(d) e^x

(ii) Which is the Linear differential equation?

(a) $\frac{dy}{dx} + y \tan x = \sec x$

(b) $\frac{dy}{dx} + y \tan x = \sec y$

(c) Both (a) & (b)

(d) None of these

(iii) Let $F(t) = \int_0^t \sin(t - \tau) \cos \tau \, d\tau$ then Laplace Transform of $F(t)$ is

(a) $\frac{s}{(s^2+1)^2}$

(b) $\frac{s}{(s^2+1)^2}$

(c) $\frac{s^2}{(s^2+1)^2}$

(d) $e^{-s} \frac{s}{(s^2+1)^2}$

(iv) Which of the following statements are true for a graph $G(V, E)$?

G1 G may be a tree with 5 vertices and sum of the degree all vertices is 10

G2 G has 6 vertices 10 edges and more than three components.

G3 Every vertex of the graph G belongs to exactly one component of the graph

G4 If G is connected then it has at least one spanning tree

(a) G1 & G2

(b) G2 & G3

(c) G3 & G4

(d) G4 & G1

Turn Over

(v) If $f(D)y = e^{2x}$ where $f(D) = D^2 - 9$ and $D \equiv \frac{d}{dx}$, then Particular Integral (P. I.) is

(a) $\frac{e^{2x}}{9}$

(b) $\frac{2e^{2x}}{9}$

(c) $\frac{2e^{2x}}{9}$

(d) None of these

(vi) Laplace transform is a

(a) Static Operation

(b) Linear Operation

(c) Dynamic Operation

(d) Non-Linear Operation

(vii) $\int_1^{\infty} \frac{1}{x^2} dx$ equal to <http://www.makaut.com>

(a) 1

(b) 0

(c) -1

(d) does not exist

(viii) If for some positive integer k , degree of vertex $d(v) = k$ for every vertex v of the graph G , then G is called

(a) a Tree

(b) a Regular graph

(c) a Connected graph

(d) All of these

(ix) Which of the following is not a type of graph:

(a) Tree

(b) Hamiltonian

(c) Euler

(d) Path

(x) $L^{-1} \left[\frac{1}{(s-99)^2 + 100} \right]$ is <http://www.makaut.com>

(a) $\frac{1}{99} e^{-10t}$

(b) $\frac{1}{10} e^{-99t} \sin 99t$

(c) $\frac{1}{10} e^{99t} \sin 10t$

(d) $\frac{1}{99} e^{-99t} \sin 99t$

(xi) The integrating factor of $x \log x \frac{dy}{dx} + y = 2 \log x$ is

(a) $\log x$

(b) $\log 2x$

(c) $\log 3x$

(d) $\log 4x$

(xii) For beta function the value of $B(1/2, 1/2)$ is

(a) π

(b) $\sqrt{\pi}$

(c) $\frac{\pi}{2}$

(d) $\frac{\pi}{4}$

Group - B**(Short Answer Type Questions)****Answer any three of the following:**

5×3=15

2. Solve : $(1 + y^2)dx = (\tan^{-1} y - x) dy$ <http://www.makaut.com>
3. Solve : $(D^2 - 5D + 6)y = x^2 e^{3x}$ where $D \equiv \frac{d}{dx}$.
4. Find $L^{-1} \left[\frac{4s+12}{s^2+10s+16} \right]$
5. Evaluate $\frac{1}{\sqrt{2\pi\sigma}} \int_{-\infty}^{\infty} \frac{e^{-ix - m\sigma^2}}{x\sigma^2} dx$ using Gamma function, where m and σ are constants.
6. Construct the graph corresponding to the following incidence matrix

$$\begin{pmatrix} 0 & -1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & -1 & 0 & 0 & 0 & 0 \\ 1 & 0 & -1 & 0 & 1 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & -1 & 1 & 1 & -1 \\ 0 & 0 & 0 & 0 & 0 & -1 & -1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

Group - C**(Long Answer Type Questions)****Answer any three of the following:**

15×3=45

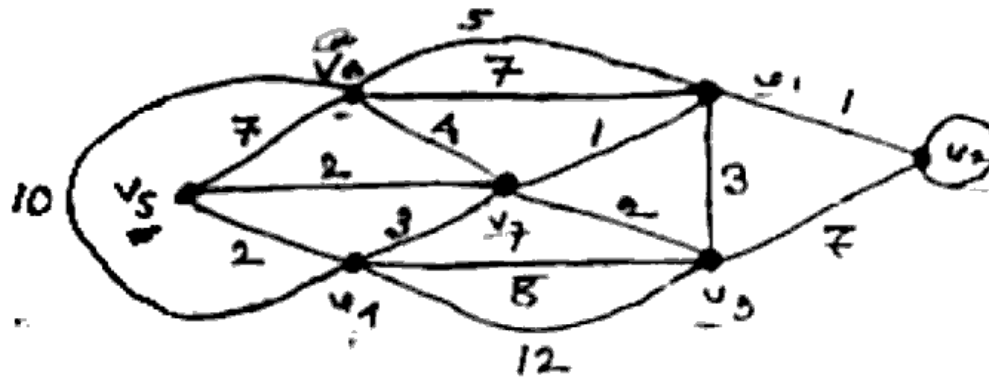
7. (a) Using the method of variation of parameter, find the complete solution of $\frac{d^2 y}{dx^2} + 4y = 4 \tan 2x$.
 (b) Solve: $\frac{d^2 y}{dx^2} + 4y = x \sin^2 x$ <http://www.makaut.com>
 (c) Evaluate $\int_0^{\infty} e^{-3t} \sin t \cos t dt$, by Laplace Transform. 5+5+5=15
8. (a) Obtain the general solution of $y = px + \sqrt{p^2 + b^2}$ and also find the singular solution
 (b) Solve: $\frac{dx}{dt} - \frac{dy}{dt} + 2y = \cos 2t$; $\frac{dx}{dt} + \frac{dy}{dt} - 2x = \sin 2t$.
 (c) Find maximum number of vertices in a connected graph having 17 edges. 5+5+5=15
9. (a) Show that $\int_0^{\frac{\pi}{2}} \sin^p x dx \times \int_0^{\frac{\pi}{2}} \sin^{p+1} x dx = \frac{\pi}{2(p+1)}$.
 (b) Solve $(x+a)^2 \frac{d^2 y}{dx^2} - 4(x+a) \frac{dy}{dx} + 6y = x$.
 (c) Using Convolution theorem verify that $\int_0^t \sin u \cos(t-u) du = \frac{t \sin t}{2}$. 4+5+6=15

10. (a) Find the differential equation of all circles of radius 'a'
 (b) By Matrix representation, check whether the following pair of graphs are isomorphic or not



(c) Prove that there exist no graphs with four edges having vertices of degree 4, 3, 2, 1 5+5+5=15

11. (a) The differential equation of a signal in time domain t is given by $F''(t) + 9F(t) = 18t$ where $F(0) = 0$; $F(\pi/2) = 0$. Find the signal using Laplace Transform. <http://www.makaut.com>
 (b) Find the shortest path between v_2 and v_3 of the following graph by using Dijkstra's method



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