



MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : M-201(O)

MATHEMATICS-II

Time Allotted : 3 Hours.

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.

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

- i) The differential equation

$$\left(y + \frac{1}{x} + \frac{1}{x^2 y} \right) dx + \left(x - \frac{1}{y} + \frac{A}{xy^2} \right) dy = 0$$
 is

exact, then the value of A is

- | | |
|------|---------|
| a) 2 | b) 1 |
| c) 0 | d) - 1. |
- ii) $\frac{xdy - ydx}{x^2 + y^2} = ?$
- | | |
|------------------------------|------------------------------|
| a) $d(\tan^{-1}xy)$ | b) $d(\tan^{-1}\frac{x}{y})$ |
| c) $d(\tan^{-1}\frac{y}{x})$ | d) none of these. |

iii) Integrating factor of $\frac{dy}{dx} + y \cot x = 2x \cos x$ is

a) $\cos x$

b) $\sin x$

c) $-\sin x$

d) none of these.

iv) $\frac{1}{D^2 + D + 1} \cos x = ?$

a) $\sin x$

b) $-\sin x$

c) $\cos x$

d) $-\cos x$.

v) $\Gamma(\frac{1}{4}) \Gamma(\frac{3}{4}) = ?$

a) $\sqrt{2\pi}$

b) $2\sqrt{\pi}$

c) $\pi\sqrt{2}$

d) none of these.

vi) The value of $\int_0^{\frac{\pi}{2}} \frac{\sin t}{t} dt$ is

a) $\frac{\pi}{3}$

b) $\frac{\pi}{6}$

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

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

vii) $L(3t + 5) = ?$

a) $\frac{3}{p^2} + 5$

b) $\frac{3}{p^2} + \frac{5}{p}$

c) $\frac{6}{p}$

d) $\frac{8}{p^2}$

viii) $L [te^{2t}]$ is equal to

- a) $\frac{1}{s-2}$ b) $2(s-2)^2$
c) $\frac{1}{(s-2)^2}$ d) $\frac{2}{s^2}$

ix) If a graph has 5 vertices and 7 edges, then the size of the adjacency matrix is

- a) 5×7 b) 7×7
c) 5×5 d) 7×5

x) Dijkstra's algorithm is used to

- a) find the shortest path from a vertex to another vertex
b) scan all vertices of graph
c) find maximum flow in a network
d) none of these.

xi) The value of $B\left(\frac{1}{2}, \frac{1}{2}\right)$ is

- a) π b) $\sqrt{\pi}$
c) $\frac{\sqrt{\pi}}{2}$ d) $\frac{\pi}{2}$

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xii) If the incidence matrix of a graph has 5 identical columns, the G has

- a) five loops
- b) five isolated vertices
- c) five parallel edges
- d) five edges in series.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Solve : $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = e^x \cos x.$

3. Solve : $\frac{dy}{dx} - \frac{\tan y}{1+x} = (1+x)e^x \sec y.$

4. Prove that a simple graph with n number of vertices and k number of components can have maximum $\frac{(n-k)(n-k+1)}{2}$ number of edges.

5. Prove that $L\left(\frac{\sin t}{t}\right) = \tan^{-1} \frac{1}{s}$. Hence find $L\left(\frac{\sin at}{t}\right)$.

6. Prove that $\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

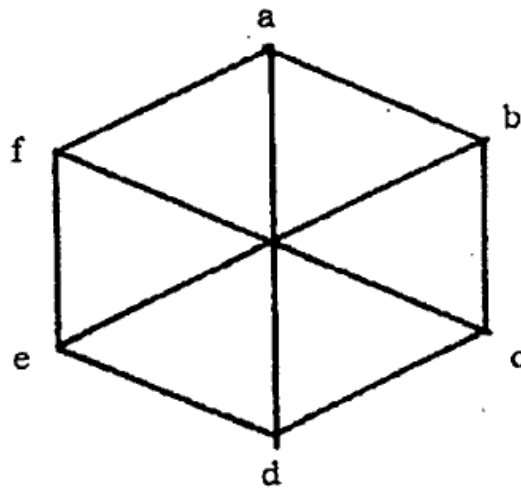
a) Show that $\int_{-\infty}^{\infty} xe^{-x^2} dx = 0$.

b) Solve the differential equation using Laplace transform.

$$(D^2 + 6D + 9)y = 1, \quad y(0) = 1 = y'(0)$$

c) Prove that a tree with n vertices has exactly $n - 1$ edges. <http://www.makaut.com> 5 + 5 + 5

8. a) Define complement of a graph. Find the complement of the following graph where a, b, c, d, e, f are the vertices of the graph :



b) Solve $(D^2 + 4)y = x \sin^2 x$.

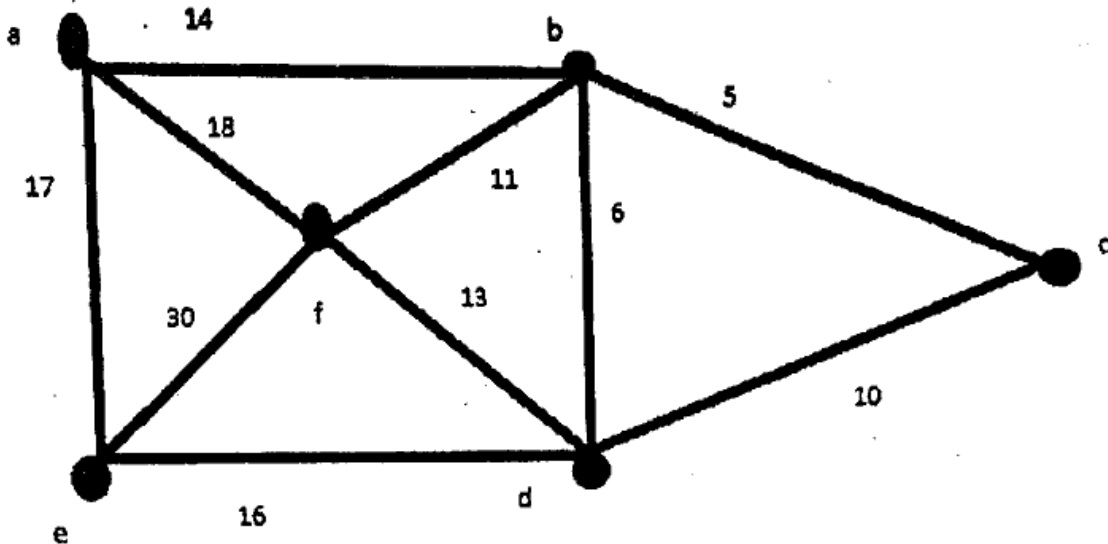
c) Find Laplace transformation of

$$\begin{cases} f(t) = \sin t, & 0 < t < \pi \\ = 0 & t > \pi \end{cases}$$

5 + 5 + 5

[Turn over

9. a) Find by Prim's algorithm the minimum spanning tree of the following graph :



b) Solve : $x \frac{dy}{dx} + y = y^2 \log x$.

c) Prove that $B(m,n) = \int_0^{\infty} \frac{x^{n-1}}{(1+x)^{m+n}} dx$. 5 + 5 + 5

10. a) Show that $\int_0^{\infty} e^{-4x} x^{\frac{3}{2}} dx = \frac{3}{128} \sqrt{\pi}$.

- b) Discuss the convergence of the integral

$$\int_0^1 \frac{dx}{x(2-x)}$$

c) Solve $\frac{dx}{dt} + 3x + y = e^t$, $\frac{dy}{dt} - x + y = e^{2t}$. 5 + 5 + 5

11. a) Solve $y = 2px - p^2$, where $p = \frac{dy}{dx}$.
- b) Suppose G is a non-directed graph with 12 edges. If G has 6 vertices each of degree 3 and the rest have degree less than 3, find the minimum number of vertices G can have.
- c) Define gamma function. Prove that

$$\Gamma(n+1) = n\Gamma(n) \qquad 5 + 5 + 5$$

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