

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code: BM-201
MATHEMATICS

Time Allotted: 3 Hours

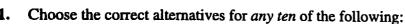
Full Marks: 70

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)



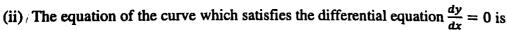
1×10=10

- (i) If (3,1) = x(1,2) + y(0,3), then the values of x and y are respectively
 - (a) 3, -5

(b) 3,1

(c) $3, -\frac{5}{3}$

(d) $3, -\frac{5}{2}$



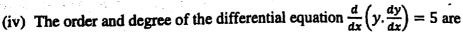
- (a) a straight line passing through the origin
- (b) a straight line parallel to x-axis
- (c) a straight line parallel to y-axis
- (d) None of these

- (iii) $\{x^n\}$ converges if
 - (a) x = 1

(b) x > 1

(c) x < -1

(d) -1 < x < 1



(a) 1, 2

(b) 2, 2

(c) 1, 1

(d) 2, 1

(v) If T(x, y, z) = (x, y, 0) for all $(x, y, z) \in R^3$ is a linear transformation, then Kernel(T) is

(a) $\{(0,0,0)\}$

(b) x-axis

(c) y-axis

(d) z-axis

Turn Over

CS/BCA/EVEN/SEM-2/BM-201/2017-18

- (vi) The series $\sum \frac{1}{n^p}$ is convergent if
 - $(a) P \geq 1$

(b) P > 1

(c) P < 1

(d) $P \leq 1$

- (vii) The sequence $\left\{ \left(1 + \frac{1}{n}\right)^n \right\}$ is
 - (a) divergent

(b) unbounded

(c) bounded.

(d) None of these

- (viii) $\frac{1}{n^2}(x^4) = ?$
 - (a) x^5
 - (c) $\frac{x^6}{30}$

- (ix) The I.F. of $\frac{dx}{dy} = x + y^2$ is

 (a) e^x

(b) e

- (d) e^{-x}
- (x) T is a linear transformation by $T(x_1, x_2) = (-x_1, -x_2)$ then the dimension of $T(V_2)$
 - (a) 2

(c) 0

- (d) None of these
- (xi) A bounded monotonic increasing sequence converges to its
 - (a) any upper bound

(b) greatest lower bound

(c) least upper bound

- (d) 0
- (xii) The differential equation $(x e^{axy} + 2y) \frac{dy}{dx} + y \cdot e^{xy} = 0$ is exact for a = ?
 - (a) 3

(b) 1

(c) 2

(d) 0

Group - B

Answer any three questions:

 $5 \times 3 = 15$

Show that the differential equation of all parabolas with foci at the origin and axes along the x-axis is

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

- Find the value of x such that the vectors (1, 2, 1), (x, 3, 1) and (2, x, 0) are linearly dependent.
- Examine the convergence of the sequence $\left\{\frac{n^n}{|n|}\right\}$.

- Solve: $(D^2 4)y = e^{2x} + e^{-4x}$
- Show that $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots$ to ∞ is a divergent series.



Group - C

Answer any three questions:

 $15 \times 3 = 45$

5

- 7. (a) Solve : $\frac{dy}{dx} + \frac{y}{x} = \frac{y^2}{x^2}$
 - (b) Let $W = \{(x, y, z) \in \mathbb{R}^3 : x + y 2z = 0\}$. Show that W is a subspace of \mathbb{R}^3 . Find a basis and dimension of W.
 - (c) From the definition, prove that, $\lim_{n \to \infty} x^n = 0$, when -1 < x < 1.

5

- (a) Prove that the vectors (1, -2, 3), (2, 3, 1) and (-1, 3, 2) form a basis of V_3 .
 - (b) Solve: $(x + y + 1) \frac{dy}{dx} = 1$
 - (c) Discuss the convergence of the series $\sum_{n=1}^{\infty} \left(\frac{n}{n-1}\right)^{n^2}$
- (a) Solve: $\frac{d^2y}{dx^2} 5\frac{dy}{dx} + 6y = x^2e^{3x}$

- (b) Determine the linear mapping $T: \mathbb{R}^3 \to \mathbb{R}^3$ which maps the basis vectors (0, 1, 1), (1, 0, 1), (1, 1, 0) of \mathbb{R}^3 to the vectors (1,2,1), (1,1,2), (2,1,1) respectively. Find dim(ker(T)).
- (c) Obtain a singular solution of the equation: (y px)(p 1) = p; $p = \frac{dy}{dx}$
- (a) If $T: \mathbb{R}^3 \to \mathbb{R}^3$ is given by T(x, y, z) = (x y, y z, z x); show that T is a linear transformation and obtain ker(T).
 - (b) Solve: $(D^2 + 1)y = \sin 2x$
 - (c) State Leibnitz's test. Using this show that $1 \frac{1}{2} + \frac{1}{3} \frac{1}{4} + \dots$ to ∞ is convergent.



- (a) Solve: $x^2 \frac{d^2y}{dx^2} x \frac{dy}{dx} + 2y = \log x$
 - (b) Solve: $(D^2 + 4)y = x \sin x$
 - (c) Test the convergence of the series $\frac{6}{1.3.5} + \frac{8}{3.5.7} + \frac{10}{5.7.9} + \dots$ to ∞ .

