Group - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following:

i) if
$$a = (1, 0, 3)$$
 and $b = (-1, 2, 5)$ then $a + 3b$ is equal to

$$\checkmark$$
a) $(-2, 6, 18)$

$$\checkmark$$
a) $(-2, 6, 18)$ b) $(2, -6, -18)$

c)
$$(2, -6, 18)$$

d)
$$(1,3,5)$$

ii) If $\sum_{n} |a_n|$ is convergent, then $\sum_{n} a_n$ is

√a) convergent

b) divergent

c) oscillatory

d) none of these

iii) A bounded sequence is

√a) convergent

b) divergent

c) oscillatory

d) none of these

iv) The series $\sum \frac{1}{n\sqrt{n+1}}$ is

√a) convergent

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- v) The integrating factor of $\frac{dy}{dx} + 2xy = x^3$ is

- a) x^3 b) x^2 $(c) e^{x^2}$ d) e^{x^3}

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- vi) The infinite series $\sum_{n=1}^{\infty} \frac{n}{n+1}$ is

- a) Convergent

 b) Divergent c) Oscillatory d) None of these
- vii) If the vectors (5,2,3),(7,3,a),(9,4,5) of a vector space \mathbb{R}^3 over \mathbb{R} be linearly independent, then the value of a is not equal to
 - √a) 2

- √b) 3 √c) 1 √d) 0

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- viii) The sequence $1, \frac{1}{2}, \frac{1}{3}, \dots, \frac{1}{n}$ is converges to
 - a) ∞

√b) 0

ix) The order and degree of the differential equation

$$\frac{d^2y}{dx^2} = 1 + 2\left(\frac{dy}{dx}\right) + \left(\frac{dy}{dx}\right)^3$$
 are

- b) 1, 2

- c) 1, 3 d) 3, 1

- x) The sequence $\{(-1)^n\}$ is
 - a) Convergent
- √b) Oscillatory
- c) Divergent
- er in Committee and the state of the d) None of these
- xi) The general solution of $\log \frac{dy}{dx} = x y$ is
 - \sqrt{a} e^y e^x = c b) e^y + e^x = c
- c) $e^{y+x}=c$

- xii) Which of the following pair can form a basis of R^2 ?

 - a) $\{(1,2),(2,4)\}$ b) $\{(0,0),(3,33)\}$
- c) $\{(2,2),(3,3)\}$ \checkmark d) $\{(1,1),(1,2)\}$

xiii) The particular integral of $(d^2y/dx^2) - 3(dy/dx) + 2y = \sin 3x$ is

a)
$$1/130(9\cos 3x - 7\sin 3x)$$

✓b)
$$1/130(7\cos 3x - 9\sin 3x)$$

c) $1/130\sin 3x$

d) none of these

Group - B

(Short Answer Type Questions)

2. Prove that the vectors $\{(1,2,2),(2,1,2),(2,2,1)\}$ are linearly independent in \mathbb{R}^3 . See Topic: LINEAR ALGEBRA, Short Answer Type Question No. 5.

3. Test the convergence of the series:
$$1 + \frac{2}{1!} + \frac{2^2}{2!} + \frac{2^3}{3!} + \frac{2^4}{4!} + \dots$$

See Topic: SERIES, Long Answer Type Question No. 5(a).

4. Solve:
$$e^{y}(1+x^{2})\frac{dy}{dx}-2x(1+e^{y})=0$$

See Topic: DIFFERENTIAL EQUATIONS, Short Answer Type Question No. 9.

5. Define a subspace of a vector space. Show that the intersection of two subspaces of a vector space is a subspace.

See Topic: LINEAR ALGEBRA, Short Answer Type Question No. 1.

6. Show that the sequence $\sqrt{2}$, $\sqrt{2+\sqrt{2}}$, $\sqrt{2+\sqrt{2}+\sqrt{2}}$ Converges to 2.

See Topic: SEQUENCE, Long Answer Type Question No. 5.

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(Long Answer Type Questions)

- 7. a) Test the convergence of the following series: $\sum \frac{n^2-1}{n^2+1}x^n$
- b) Examine whether the differential equation $(e^y + 1)\cos x dx + e^y \sin y dy = 0$ is exact or not.
- c) Find the basis and the dimension of the subspace W of R^3 where $W = \{(x, y, z) \in R^3 : 2x y + 3z = 0\}$
- a) See Topic: SERIES, Long Answer Type Question No. 2(i).
- b) See Topic: DIFFERENTIAL EQUATIONS, Long Answer Type Question No. 6(c).
- c) See Topic: LINEAR ALGEBRA, Long Answer Type Question No. 18.

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8. a) Solve
$$\frac{dy}{dx} = \sin(x+y)$$

- b) Let $T: \mathbb{R}^2 \to \mathbb{R}^2$ be a linear transformation such that T(1,1)=(2,-3) and T(1,-1)=(4,7). Find the matrix of T.
- c) Prove that the sequence $\left\{\frac{1}{(n+1)^2} + \frac{1}{(n+2)^2} + \dots + \frac{1}{(2n)^2}\right\}$ is convergent. Find its limit
- a) See Topic: DIFFERENTIAL EQUATIONS, Long Answer Type Question No. 14.
- b) See Topic: LINEAR ALGEBRA, Long Answer Type Question No. 19.
- c) See Topic: SEQUENCE, Long Answer Type Question No. 6.
- 9. a) Form a differential equation by eliminating A and B from the following: $y = A\cos x + B\sin x$
- b) Find whether the following vectors are linearly dependent or not $\{(1,2,3),(2,3,1),(3,2,1)\}$
- c) Discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{\cos n\pi}{n^2 + 1}$
- a) See Topic: DIFFERENTIAL EQUATIONS, Long Answer Type Question No. 15.
- b) See Topic: LINEAR ALGEBRA, Long Answer Type Question No. 20.
- c) See Topic: SERIES, Long Answer Type Question No. 10.
- 10. a) Solve: $\frac{dy}{dx} + y \tan x = y^3 \cos x$
- b) For what values of x the three vectors (1,1,2),(x,1,1),(1,2,1) are linearly independent.

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- c) Solve: $y = px + \sqrt{1 + p^2}$
- a) & c) See Topic: DIFFERENTIAL EQUATIONS, Long Answer Type Question No. 16(a) & (b).
- b) See Topic: LINEAR ALGEBRA, Long Answer Type Question No. 21.
- 11. a) Prove that the vectors (x_1, y_1) and (x_2, y_2) are linearly dependent, if and only if $x_1y_2-x_2y_1=0$
- b) Test the convergence of the series $\sum \frac{x^n}{n\sqrt{n+1}}$
- c) Find the linear transformations T, where $T:R^3\to R^2$ such that $T(1,0,0)=(1,2)\,T(0,1,0)=(1,-1)$ and T(0,0,1)=(1,0).

MATHEMATICS - II

g) See Topic: LINEAR ALGEBRA, Long Answer Type Question No. 5(c).

b) See Topic: SERIES, Long Answer Type Question No. 11.

c) See Topic: LINEAR ALGEBRA, Long Answer Type Question No. 22.