

TEST-I

SERIES : 55

Test Booklet Serial No.**55564**....

PLEASE DO NOT BREAK THE SEAL, UNTIL ASKED TO DO SO BY INVIGILATOR

Number of Pages : 40

Time Allowed : 3 Hours

Number of Questions : 100

M. Marks : 400

Blank pages are available for rough calculations at the end of the Test Paper.

Do not use your own Blank Pages for Rough Work.

Use only **1** to **100** ovels in ORS Sheet for answering **1** to **100** questions.

Name of the Candidate

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- 1. OPENING & CHECKING OF THE QUESTION PAPER BOOKLET AND ORS (OMR Response Sheet) :**
Break open the seal of the Question Paper Booklet only when the announcement is made by the Invigilator. The ORS is placed inside the Booklet. After breaking the seal and before attempting the questions, candidate should immediately check for :
 - (1) The number of the printed pages in the Question Paper Booklet is the same as mentioned on the cover page of the Booklet and printing error in the Booklet pages & ORS, if any, and
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- 4.** There will be negative marking for every wrong answer. (one mark will be deducted for each incorrect answer.) Four marks will be given for every correct answer. Note that there is only one correct alternative for each question.

Note : The question paper consists of four parts :

Part I : (Mathematics) Q. Nos. 1-53.

Part II : (Computer Science) Q. Nos. 54-83.

Part III : (Aptitude Test) Q. Nos. 84-92.

Part IV : (Communication Skills) Q. Nos. 93-100.

PART I : (MATHEMATICS)

1. The ratio of the sum of the roots of the equation, $8x^3 + px^2 - 2x + 1 = 0$ to the product of the roots of the equation, $5x^3 + 7x^2 - 3x + q = 0$ is

3 : 2, then the value of $\frac{p-q}{p+q}$ is :

(1) $\frac{3}{2}$

(2) $\frac{2}{3}$

(3) $\frac{2}{5}$

(4) $\frac{1}{5}$

2. If α, β, γ are three numbers s.t. :

$$\alpha + \beta + \gamma = -2$$

$$\alpha^2 + \beta^2 + \gamma^2 = 6$$

$$\alpha^3 + \beta^3 + \gamma^3 = -5,$$

then $\alpha^4 + \beta^4 + \gamma^4$ is equal to :

(1) -10

(2) -2

(3) 2

(4) 10

3. The points $5 + 5i$, $1 - 3i$, $-4 + 2i$ and $-2 + 6i$ in the Argand plane are :

(1) Collinear

(2) Concyclic

(3) The vertices of a parallelogram

(4) The vertices of a square

4. The radius of the circle, given by $|z + i| = 3|z - i|$, is :

- | | |
|-------------------|-------------------|
| (1) $\frac{1}{2}$ | (2) $\frac{3}{4}$ |
| (3) $\frac{4}{3}$ | (4) 2 |

5. Which of the following groups is *not* cyclic ?

- (1) $G_1 = \{2, 4, 6, 8\}$ w.r.t. \odot_{10}
- (2) $G_2 = \{0, 1, 2, 3\}$ w.r.t. \oplus_4
- (3) G_3 = Group of symmetries of a rectangle w.r.t. (o)
- (4) G_4 = 4th roots of unity w.r.t. (.)

6. If $G = \{f_{ab} \mid a, b \in R, a \neq 0\}$ where $f_{ab}(x) = ax + b \forall x \in R$, and

$H = \{g_b \mid b \in R\}$ where $g_b(x) = x + b \forall x \in R$, then :

- (1) H is not a subset of G
- (2) H is a subset of G, but it is not a subgroup of G
- (3) H is a subgroup of G, but it is not normal in G
- (4) H is a normal subgroup of G

7. Let R be any ring and $S = L \cap X$, where L is a left and X is a right ideal of R. Which of the following always holds ?

- (1) S is a subring of R
- (2) S is a left ideal of R
- (3) S is a right ideal of R
- (4) S is an ideal of R

8. Let I be the set of integers. Which of the following is a commutative ring w.r.t. matrix addition and matrix multiplication ?

$$(1) \quad R_1 = \left\{ \begin{bmatrix} a & b \\ 0 & 0 \end{bmatrix} \mid a, b \in I \right\}$$

$$(2) \quad R_2 = \left\{ \begin{bmatrix} a & 0 \\ b & 0 \end{bmatrix} \mid a, b \in I \right\}$$

$$(3) \quad R_3 = \left\{ \begin{bmatrix} 0 & 0 \\ 0 & a \end{bmatrix} \mid a \in I \right\}$$

$$(4) \quad R_4 = \left\{ \begin{bmatrix} 0 & b \\ c & 0 \end{bmatrix} \mid b, c \in I \right\}$$

9. Consider the three sets :

$$S_1 = \{(-1, -3, 4), (3, -6, 8), (4, -3, 4)\}$$

$$S_2 = \{(1, 2, 3), (3, 7, 8), (1, 3, 2)\}$$

$$\text{and } S_3 = \{(2, 2, -1), (-2, 3, 1), (4, 2, -1)\}$$

Now answer which of the following is true ?

- (1) S_1 is linearly independent, but S_2 is not
- (2) S_2 is linearly independent, but S_3 is not
- (3) S_3 is linearly independent, but S_1, S_2 are not
- (4) S_1, S_2 and S_3 are linearly dependent

10. Which of the following is *not* a vector space over R ?

- (1) $V_1 = \{\alpha_1, \alpha_2, \alpha_3 \mid \alpha_i \in R, \alpha_3 = 0\}$
- (2) $V_2 = \{\alpha_1, \alpha_2, \alpha_3 \mid \alpha_i \in R, \alpha_1 - \alpha_2 = 1\}$
- (3) $V_3 = \{\alpha_1, \alpha_2, \alpha_3 \mid \alpha_i \in R, \alpha_1 - \alpha_2 = 0\}$
- (4) $V_4 = \{\alpha_1, \alpha_2, \alpha_3 \mid \alpha_i \in R, 2\alpha_3 = \alpha_1\}$

11. $\lim_{x \rightarrow -1} \frac{\sqrt{\pi} - \sqrt{\cos^{-1} x}}{\sqrt{x+1}}$ is equal to :

- | | |
|-----------------------------|-----------------------------|
| (1) $\frac{1}{\sqrt{2\pi}}$ | (2) $\frac{1}{2\sqrt{\pi}}$ |
| (3) $\frac{1}{\sqrt{\pi}}$ | (4) $\sqrt{\pi}$ |

12. If f be a function defined on R by $f(x) = \begin{cases} \frac{x-3}{|x|-3}, & \text{when } x \neq \pm 3 \\ 0, & \text{when } x = \pm 3 \end{cases}$

then :

- (1) f is discontinuous at $x = 3$ and $\lim_{x \rightarrow 3} f(x)$ does not exist
- (2) f is discontinuous at $x = -3$ and $\lim_{x \rightarrow -3} f(x)$ does not exist
- (3) f is continuous at $x = 3$
- (4) f is discontinuous at $x = -3$

13. If the size of a slowly growing bacteria culture is given by $N(t) = N_0 + 50t - 6t^2$ approximately, where N_0 is the size when $t = 0$ and t is the time in hours, then the growth rate when $t = 4$ hours is :

(1) 1

(2) 2

(3) 4

(4) 8

14. $C = C(x, t) = \frac{e^{-x^2/4at}}{\sqrt{t}}$ is the solution of the diffusion equation :

$$(1) \quad \frac{\partial^2 C}{\partial x^2} - a \frac{\partial C}{\partial t} = 0$$

$$(2) \quad \frac{\partial^2 C}{\partial x^2} + a \frac{\partial C}{\partial t} = 0$$

$$(3) \quad a \frac{\partial^2 C}{\partial x^2} + \frac{\partial C}{\partial t} = 0$$

$$(4) \quad a \frac{\partial^2 C}{\partial x^2} - \frac{\partial C}{\partial t} = 0$$

15. If $y = \cos(m \sin^{-1} x)$ and $\frac{d^n y}{dx^n} = y_n$, then :

$$(1) \quad (1 - x^2)y_2 - xy_1 - m^2y = 0$$

$$(2) \quad (1 - x^2)y_2 + xy_1 - m^2y = 0$$

$$(3) \quad (1 - x^2)y_2 - xy_1 + m^2y = 0$$

$$(4) \quad (1 - x^2)y_2 + xy_1 + m^2y = 0$$

16. If $u = \cos^{-1} \left(\frac{x^3 - y^3}{x + y} \right)$ and $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = k \cot u$, then k is equal to :

(1) 2

(2) 1

(3) -1

(4) -2

17. The number of asymptotes of the curve, $(y - 2)^2 (x^2 - 4) = x^4 + 16$, is :

(1) 4

(2) 3

(3) 2

(4) 1

18. The dimensions (in cm) of the base of a rectangular box of greatest volume that can be constructed from 450 cm^2 card-board, if the box is to be 3-times as long as it is wide, are :

(1) $5, \frac{5}{3}$ (2) $10, \frac{10}{3}$

(3) 12, 4

(4) 15, 5

19. If the integral $\int e^x \frac{2 - \sin 2x}{1 - \cos 2x} dx$ is equal to $ae^x + C$, then a is equal to :

(1) $\tan x$ (2) $\cot x$ (3) $-\cot x$ (4) $-\tan x$

20. The value of the integral $\int_0^{\infty} \frac{x^2 dx}{(x^2 + 1)(x^2 + 4)}$ is :

(1) $-\frac{\pi}{2}$

(2) $-\frac{\pi}{4}$

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

(4) $\frac{\pi}{6}$

21. If $I_n = \int_0^{\pi/4} \tan^n x dx$, then :

(1) $(n+1)(I_{n+1} + I_{n-1}) = 1$

(2) $n(I_{n+1} + I_{n-1}) = 1$

(3) $(n-1)(I_{n-1} - I_{n+1}) = 1$

(4) $n(I_{n+1} - I_{n-1}) = 1$

22. The integral $\int_0^{3/2} [x^2] dx$ (where $[x]$ stands for the greatest integer $\leq x$) is equal to :

(1) $\sqrt{2} - 1$

(2) $2 - \sqrt{2}$

(3) $\sqrt{2} + 1$

(4) $2 + \sqrt{2}$

23. The slope of the tangent of a curve $y = f(x)$ at $(x, f(x))$ is $2x + 1$. If the curve passes through $(-1, 0)$, then the area (in sq. units) bounded by the curve, x -axis and the line $x = 2$, is :

(1) 2

(2) $\frac{8}{3}$

(3) $\frac{14}{3}$

(4) 5

24. Which of the following is *not* a closed set?

- (1) The set N of natural numbers
- (2) The set Q of rational numbers
- (3) The derived set of a set
- (4) The set = $\{(-1)^n \mid n \in \mathbb{N}\}$

25. The sequence $\langle a_n \rangle$, where

$$a_n = \frac{1}{n^2} + \frac{1}{(n+1)^2} + \frac{1}{(n+2)^2} + \dots + \frac{1}{4n^2}$$

converges to :

- | | |
|-------|-------------------|
| (1) 0 | (2) $\frac{1}{2}$ |
| (3) 1 | (4) 2 |

26. The sequence $\langle a_n^{\frac{1}{n}} \rangle$ where

$$a_n = \frac{n^n}{(n+1)(n+2)\dots(n+n)}$$

converges to the limit :

- | | |
|-------------------|-------------------|
| (1) e | (2) $\frac{e}{2}$ |
| (3) $\frac{1}{e}$ | (4) $\frac{e}{4}$ |

27. Which of the following series, whose n th term is given below, is not convergent ?

- | | |
|------------------------------------|---|
| (1) $\sqrt{n+1} - \sqrt{n}$ | (2) $\frac{\sqrt{n+2} - \sqrt{n+1}}{n}$ |
| (3) $\frac{\sqrt{n}}{(n+1)^2 - 1}$ | (4) $\frac{n^{3/2}}{n^3 + 3}$ |

28. If f be a function defined as

$$f(x) = \begin{cases} x^2 \cos\left(\frac{1}{x}\right), & \text{if } x \neq 0 \\ 0 & , \text{ if } x = 0 \end{cases}$$

then :

- (1) f' is continuous $\forall x \in \mathbb{R}$
- (2) f' is derivable $\forall x \in \mathbb{R}$
- (3) f is derivable $\forall x \in \mathbb{R}$ and f' is continuous at $x = 0$
- (4) f is derivable $\forall x \in \mathbb{R}$ and f' is not continuous at $x = 0$

29. If a function f be defined as :

$$f(x) = xe^{x(1-x)}, \forall x \in \mathbb{R}$$

then f is :

- (1) increasing in $\left[-\frac{1}{2}, 1\right]$
- (2) increasing in $\left]-\infty, -\frac{1}{2}\right]$
- (3) decreasing in $\left[-\frac{1}{2}, 1\right]$
- (4) decreasing in $\left]-\infty, \infty\right[$

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30. The number of real values of k for which the equation $x^4 + 4x + k = 0$ has two distinct roots in the interval $[-1, 1]$ is :

(1) 4

(2) 2

(3) 1

(4) 0

31. If C is the arc of the cycloid, $x = 2(t - \sin t)$, $y = 2(1 - \cos t)$ joining the points $(0, 0)$ and $(4\pi, 0)$, then the integral $\int_C (ydx - xdy)$ is equal to :

(1) 12π (2) 24π (3) 36π (4) 48π

32. The radius of convergence of the series $x + \frac{x^2}{2^2} + \frac{|2|}{3^3}x^3 + \frac{|3|}{4^4}x^4 + \dots$, is :

(1) e (2) $\frac{1}{e}$ (3) $\frac{e}{2}$ (4) $\frac{2}{e}$

33. Which of the following functions are linearly independent ?

(1) $\cos \alpha x, \sin \alpha x, \sin (\alpha x + k)$ (2) $\cos \alpha x, -\sin \alpha x, \cos (\alpha x - k)$ (3) $e^x, 2e^{2x}, 3e^{-3x}$ (4) $x, e^x, xe^x, (2 - 3e^x)$

34. The order of the D.E. (differential equation) whose general solution is given by :

$$y = (C_1 + C_2) \cos(2x + C_3) + C_4 e^{5x + C_5}$$

(where C_1, C_2, C_3, C_4 and C_5 are arbitrary constants) is :

- | | |
|-------|-------|
| (1) 2 | (2) 3 |
| (3) 4 | (4) 5 |

35. The D.E. of all parabolas whose axes are parallel to x -axis is :

- | | |
|------------------------|--|
| (1) $3y_2^2 = y_1 y_3$ | (2) $2y_2^2 = y_1 y_3$ |
| (3) $yy_2^2 = y_1 y_3$ | (4) $y_2 y_3 = 3y_1^2$ (where $y_n = \frac{d^n y}{dx^n}$) |

36. $y = px^2 + qx$ is a solution of the D.E. :

- | | |
|--------------------------------|--------------------------------|
| (1) $x^2 y_2 - 2xy_1 - 2y = 0$ | (2) $x^2 y_2 + 2xy_1 + 2y = 0$ |
| (3) $x^2 y_2 + 2xy_1 - 2y = 0$ | (4) $x^2 y_2 - 2xy_1 + 2y = 0$ |

37. The integrating factor of the D.E.

$$(xy^2 + 2x^2 y^3) dx + (x^2 y - x^3 y^2) dy = 0,$$

is :

- | | |
|--------------------------|--------------------------|
| (1) $\frac{1}{2x^3 y^2}$ | (2) $\frac{1}{2x^2 y^3}$ |
| (3) $\frac{1}{3x^3 y^3}$ | (4) $\frac{1}{3x^2 y^2}$ |

38. The solution of the D.E. $(x^2 + y^2 + x) dx + xy dy = 0$, is :

- | | |
|--------------------------------|--------------------------------|
| (1) $x^2(4 - 3x^2 - 6y^2) = c$ | (2) $x^2(4 + 3x^2 + 6y^2) = c$ |
| (3) $y^2(4 + 3x^2 + 6y^2) = c$ | (4) $(x^2 + 2y^2 + 3)y^2 = c$ |

39. If one of the solution in the complete integral of the D.E. :

$$\frac{dx}{y+z} = \frac{dy}{z+x} = \frac{dz}{x+y}$$

is $(x - y) = c_1(y - z)$, then the other solution in it is :

- | | |
|----------------------------------|----------------------------------|
| (1) $(x + y + z)(x + y)^2 = c_2$ | (2) $(x - y + z)(x - y)^2 = c_2$ |
| (3) $(x + y + z)(x - y)^2 = c_2$ | (4) $(x + y - z)(x + y)^2 = c_2$ |

40. The complete solution of the D.E. $x^2y_2 - 3xy_1 + 4y = 2x^2$, is :

- | | |
|---|---|
| (1) $y = (c_1 + c_2 \ln x)x^2 + x^2(\ln x)^2$ | (2) $x(c_1 + c_2 \ln x) - x^2(\ln x)^2$ |
| (3) $y = (c_1 + c_2 \ln x)x^2 - x^2(\ln x)^2$ | (4) $x(c_1 + c_2 \ln x) + x^2(\ln x)^2$ |

41. The equation of the chord PQ of the ellipse, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, where P and Q have eccentric angles $\alpha + \beta$ and $\alpha - \beta$ respectively, is :

- | | |
|--|--|
| (1) $\frac{x \cos \alpha}{a} + \frac{y \sin \beta}{b} = \sin \beta$ | (2) $\frac{x \cos \alpha}{a} + \frac{y \sin \beta}{b} = \cos \beta$ |
| (3) $\frac{x \sin \alpha}{a} + \frac{y \cos \beta}{b} = \sin \alpha$ | (4) $\frac{x \sin \alpha}{a} + \frac{y \cos \beta}{b} = \cos \alpha$ |

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42. If e_1 and e_2 be the eccentricities of a hyperbola and its conjugate respectively, then :
- (1) $e_1^2 - e_2^2 - e_1^2 e_2^2 = 0$ (2) $e_2^2 - e_1^2 + e_1^2 e_2^2 = 0$
 (3) $e_1^2 + e_2^2 - e_1^2 e_2^2 = 0$ (4) $e_1^2 - e_2^2 + e_1^2 e_2^2 = 0$
43. The radius of the circle $x^2 + y^2 + z^2 - 2x + 4y + 2z - 6 = 0$, $x + 2y + 2z - 4 = 0$ is :
- (1) 1 (2) $\sqrt{3}$
 (3) 2 (4) $2\sqrt{3}$
44. The equation of the right circular cylinder which passes through the circle, $x^2 + y^2 + z^2 = 9$, $x - y + z = 3$ is :
- (1) $x^2 + y^2 + z^2 + xy - yz + zx - 9 = 0$
 (2) $x^2 + y^2 + z^2 - xy + yz - zx + 9 = 0$
 (3) $x^2 + y^2 + z^2 - xy - yz + zx + 9 = 0$
 (4) $x^2 + y^2 + z^2 + xy + yz - zx - 9 = 0$
45. A uniformly accelerated automobile passes two telephone poles with velocities 10 and 30 km/h respectively. Its velocity, when it is half-way between the poles, is :
- (1) $8\sqrt{10}$ km/h (2) $5\sqrt{10}$ km/h
 (3) $10\sqrt{5}$ km/h (4) $10\sqrt{3}$ km/h

46. The centre of gravity of a solid hemisphere of radius = a , lies on its central radius at a distance ka from the centre where k is :

(1) $\frac{1}{3}$

(2) $\frac{3}{8}$

(3) $\frac{2}{5}$

(4) $\frac{1}{2}$

47. If A and B are two events s.t. $P(A) - P(B) = \frac{1}{6}$, $P(A \cup B) = \frac{5}{6}$ and $P(A \cap B) = \frac{1}{3}$, then $\frac{P(A)}{P(B)}$ is equal to :

(1) $\frac{4}{3}$

(2) $\frac{5}{4}$

(3) $\frac{4}{5}$

(4) $\frac{3}{4}$

48. If 2 persons are selected at random from n (≥ 3) persons sitting in a row, then the probability that they are not together, is :

(1) $\frac{2}{n-1}$

(2) $1 - \frac{1}{n}$

(3) $1 - \frac{3}{n}$

(4) $1 - \frac{2}{n}$

49. A bag contains $(2m + 1)$ coins. It is known that m of these coins have a head on both sides and the remaining coins are fair. A coin is picked up at random from the bag and tossed. If the probability that the toss results in a head is $14/19$, then m is equal to :

(1) 8

(2) 9

(3) 10

(4) 11

50. If a coin is tossed till a head appears, then the expectation of the number of tosses is :

(1) 1.00

(2) 1.50

(3) 1.75

(4) 2.00

51. If $\vec{r} = (t+1)\hat{i} + (t^2+1)\hat{j} + (t^3-1)\hat{k}$, then $\frac{d^2\vec{r}}{dt^2} \times \frac{d\vec{r}}{dt}$ at $t = 1$, is :

(1) $2(3\hat{i} - 3\hat{j} + \hat{k})$ (2) $2(-3\hat{i} + 3\hat{j} - \hat{k})$ (3) $2(-3\hat{i} + 3\hat{j} + \hat{k})$ (4) $2(3\hat{i} - 3\hat{j} - \hat{k})$

52. If $u = x + y + z$, $v = x^2 + y^2 + z^2$ and $w = xy + yz + zx$, then $(\text{grad } u) \cdot [(\text{grad } v) \times (\text{grad } w)]$ depends upon :

(1) x (2) y (3) z (4) none of x, y, z

53. The directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at the point $(1, -1, -1)$ in the direction of the vector $2\hat{i} + 3\hat{j} + 6\hat{k}$ is $\frac{p}{7}$, where p is :

(1) 40

(2) 36

(3) 28

(4) 24

PART II : (COMPUTER SCIENCE)

54. What is the range of signed int data type, in a compiler in which size of int is two bytes ?

(1) - 255 to 255

(2) - 32767 to 32767

(3) - 32767 to 32768

(4) - 32768 to 32767

55. Which of the following is a invalid variable name in C/C++ ?

(1) --

(2) A0

(3) 0A

(4) AAAAAAAAAA

56. What will be output when you will execute the following C code ?

```
#include<stdio.h>
```

```
void main( ){
```

```
    int a=100;
```

```
    if (a>10)
```

```
        printf("first");
```

```
    else if(a>20)
```

```
        printf("second");
```

```
    else if(a>30)
```

```
        printf("third");
```

```
}
```

(1) First

(2) Third

(3) FirstSecondThird

(4) Runtime Error : More than one condition is/are true

57. What will be output of the following C program ?

```
#include<stdio.h>

int main( ){

    char * ____Time____="world";

    printf("%s", ____Time____);

    return 0;
}
```

- | | |
|-----------|-----------------------|
| (1) world | (2) null |
| (3) w | (4) compilation error |

58. What will be output of the following C program ?

```
#include<stdio.h>

int main( ){

    int x;

    int y;

    x+y=10;

    x=3;

    printf("%d", y);

    return 0;
}
```

- | | |
|-------------------|-----------------------|
| (1) 10 | (2) 7 |
| (3) Garbage value | (4) Compilation error |

59. What will be output of the following C program ?

```
#include<stdio.h>

int main( ){
    int i;
    for (i=0; i<=5; i++);
    printf("%d", i);
    return 0;
}
```

- (1) 5
- (2) 6
- (3) 0
- (4) Garbage as it is undefined outside the loop

60. An equivalent representation for the Boolean expression $A' + 1$ is :

- (1) A
- (2) A'
- (3) 1
- (4) 0

61. Simplify the Boolean expression $(A + B + C)(D + E)' + (A + B + C)(D + E)$ and choose the best answer :
- (1) $A + B + C$ (2) $D + E$
 (3) $A'B'C'$ (4) $D'E'$
62. Minimum number of bits required to represent numbers in the range – 9 to 7 using 2's complement representation is :
- (1) 6 (2) 3
 (3) 5 (4) 4
63. Shifting binary data to the left by one bit position using shift registers amounts to :
- (1) Division by 2
 (2) Subtraction of 2
 (3) Addition of 2
 (4) Multiplication by 2

64. Which of the following is true about the data types "char", "short", "long" and "int", in C language ?

- (1) All of them store an integer value
- (2) "char", "short" and "int" store an integer value whereas "long" stores a real value
- (3) "char" stores only English alphabets, "long" stores real values and "int" stores integers
- (4) None of the above

65. What is the value of the expression $3\&\&2\&5$ in C language ?

- (1) 0
- (2) 1
- (3) 2
- (4) 5

Which of the following is true about a static element ?

- (1) Its value cannot be changed during the lifetime of a program
- (2) Its value remains in the memory forever
- (3) Its value remains in the memory throughout the lifetime of the function in which it is declared and its memory is released after the function returns
- (4) Its value remains in the memory throughout the lifetime of the program and its memory is released after the program terminates

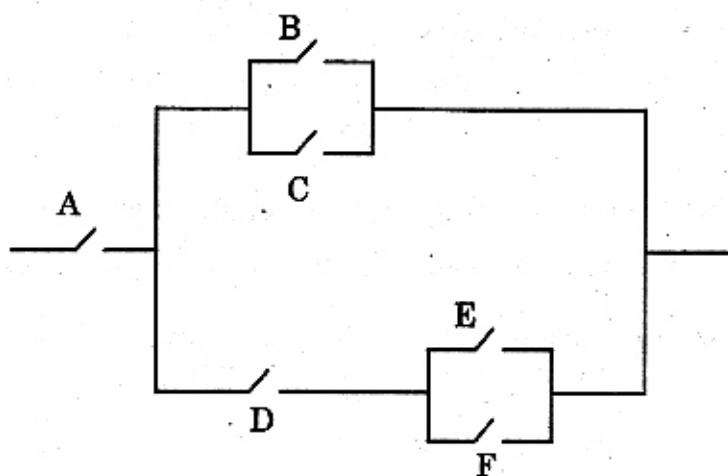
What will be the output, if any, of the following code segment ?

```
void main ( ){
    int min=30;
    minimum(20, 10);
    printf("%s, %d%", "Minimum of 10, 20 and 30 is", min);
}
```

```
int minimum(int a, int b){
    if (a > b) return b;
    else return a;
```

- (1) Minimum of 10, 20 and 30 is 10
- (2) Minimum of 10, 20 and 30 is 20
- (3) Minimum of 10, 20 and 30 is 30
- (4) There will be no output

68. What Boolean function does the following circuit represent at the output ?



- (1) $A + ((B \cdot C) \cdot D + (E \cdot F))$
- (2) $A + ((B + C) + D + (E \cdot F))$
- (3) $A \cdot ((B + C) \cdot D + (E + F))$
- (4) $A \cdot ((B + C) + D \cdot (E + F))$

69. How many address lines and input-output data lines are required for a memory unit of 4 giga-words having 128 bits per word ?

- (1) 32, 7
- (2) 32, 128
- (3) 20, 7
- (4) 20, 128

70. The dual of a Boolean function is obtained by :
- (1) interchanging all 0s and 1s only
 - (2) changing all 0s to 1s only
 - (3) changing all 1s to 0s only
 - (4) interchanging (i) all 0s and 1s and (ii) '+' and '•'
71. Which of the following statements would have different effect from others ?
- (1) $j=j+1;$
 - (2) $j++;$
 - (3) $j+=1;$
 - (4) $j=+1;$
72. Consider the following code segment :

```

int i=1; k=1;

while (i<15){

    if(i%2==1)

        {i++; continue; }

    if(i%2==0)

        break;

    k++; i++;

}

```

What will be the value of "k" after the loop is completely executed ?

- (1) 1
- (2) 7
- (3) 8
- (4) 15

SERIES 55

73. In which of the following code segments, the variable x evaluates to - 4 ?

- (1) int x = -8; x<<=1;
- (2) int x = -8; x<<=2;
- (3) int x = -8; x>>=1;
- (4) int x = -8; x>>=2;

74. The following function when called as sub(a, sub (a, b)) will return :

```
int sub(int a, int b){  
    return ((x<y) ? 0:(x - y));  
}
```

- (1) maximum of a and b
- (2) minimum of a and b
- (3) positive differnece of a and b
- (4) sum of a and b

75. What will be the output of the following code segment ?

```

int dummy(int i) {
    if (i==1 || i==0)
        return 1;
    else
        return (i * dummy (i-1));
}

void main( ){
    for (int i=6, sum = 0; i>=0; i-=2)
        sum +=dummy(i);
    cout <<"\n" <<sum;
}

```

- | | |
|---------|---------|
| (1) 746 | (2) 747 |
| (3) 874 | (4) 875 |

76. The output of a logic gate is 1 when all its inputs are at logic 1. The gate is either :

- | | |
|---------------------|---------------------|
| (1) a NAND or a NOR | (2) an AND or an OR |
| (3) an OR or an XOR | (4) an AND or a NOR |

SERIES 55

77. The logical expression $y = \Sigma m(0, 3, 6, 7, 10, 12, 15)$ is equivalent to :

- (1) $y = \prod M(0, 3, 6, 7, 10, 12, 15)$
- (2) $y = \prod M(1, 2, 4, 5, 8, 9, 11, 13, 14)$
- (3) $y = \sum m(1, 2, 4, 5, 8, 9, 11, 13, 14)$
- (4) $y = \sum m(1, 2, 4, 6, 7, 10, 12, 14)$

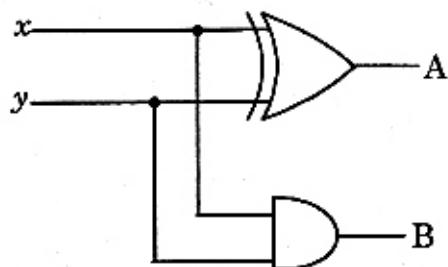
78. In K-map simplification, a group of eight adjacent ones leads to a term with :

- (1) one literal less than the total number of variables
- (2) two literals less than the total number of variables
- (3) three literals less than the total number of variables
- (4) four literals less than the total number of variables

79. Programs stored in which of the following memories cannot be erased ?

- | | |
|---------------|------------------|
| (1) RAM | (2) ROM |
| (3) Hard disk | (4) Cache memory |

80. The given logic gate diagram represents the combinational circuit for :



$$A = x \oplus y$$

$$B = xy$$

- | | |
|----------------|---------------------|
| (1) Half adder | (2) Half subtractor |
| (3) Full adder | (4) Full subtractor |

81. Octal representation of 673 is :

- | | |
|---------------|---------------|
| (1) 110111010 | (2) 110111011 |
| (3) 101110011 | (4) 110101011 |

82. The maxterm corresponding to decimal number 15 is :

- | | |
|---------------------|---|
| (1) ABCD | (2) $\bar{A}\bar{B}\bar{C}\bar{D}$ |
| (3) $A + B + C + D$ | (4) $\bar{A} + \bar{B} + \bar{C} + \bar{D}$ |

83. Which of the following is said to be a universal gate ?

- | | |
|----------|---------|
| (1) AND | (2) OR |
| (3) NAND | (4) NOT |

PART III : (APTITUDE TEST)

87. Find missing number in the following series of numbers :

5, 27, 7, ?, 9, 343, 11, 729

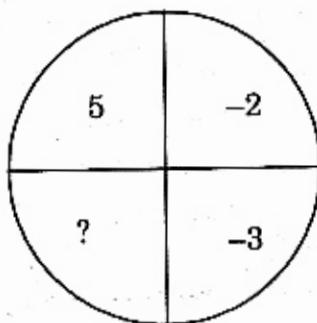
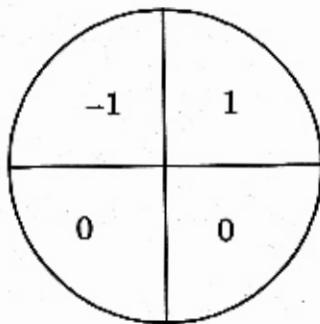
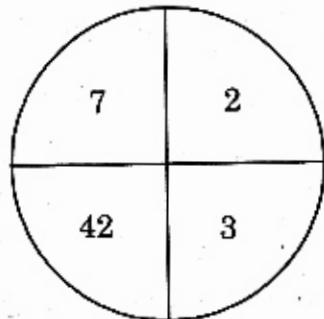
(1) 216

(2) 64

(3) 25

(4) 125

88.



Which one of the following should replace the question mark ?

(1) 0

(2) 82

(3) -30

(4) 30

89. If CENTURION is coded as 325791465 and RANK as 18510, then figure 106528 stands for :

- | | |
|-----------|-----------|
| (1) ACETR | (2) KEANO |
| (3) KONEA | (4) CREAT |

Read the following information and then answer the questions that follow :

- (i) There is a group of six persons living in a four-storeyed building. The persons are Ashok, Nilesh, Abha, Anil, Om and Mukesh. Each storey of the building has two flats. Thus, there are eight flats in all, two of them being empty.
- (ii) The heaviest of the group lives on top floor while the lightest lives on the ground floor.
- (iii) Abha is heavier than Nilesh, who, in turn is heavier than Mukesh.
- (iv) Om is lighter than Anil.
- (v) One of the flats on the first floor is vacant while one on the second floor is also vacant.
- (vi) Ashok is neither the heaviest nor the lightest.
- (vii) There are only two persons heavier than Abha and Ashok is not one of them.
- (viii) Nilesh shares the floor with the heaviest of the group while Abha shares it with the lightest.

Now answer the question nos. 90 to 92 :

90. Who is the heaviest of the group ?

- | | |
|-----------|----------------|
| (1) Anil | (2) Abha |
| (3) Ashok | (4) Cannot say |

91. With whom does Abha share the floor ?

- | | |
|------------|----------------|
| (1) Om | (2) Ashok |
| (3) Mukesh | (4) Cannot say |

92. On which floor does Ashok live ?

- | | |
|------------------|------------------|
| (1) Ground floor | (2) Second floor |
| (3) Top floor | (4) Cannot say |

PART IV : (COMMUNICATION SKILLS)

Read the following paragraph and answer the question nos. 93 to 96 :

Mahatma Gandhi was looked on by many as the epitome of Hindu tradition, but this is a false judgement for he was very much influenced by Western ideas. Gandhi believed in the fundamentals of his ancient culture, but his

passionate love of the underdog and his antipathy to caste, though not unprecedented in ancient India, were unorthodox in the extreme, and owed more to European 19th century liberalism than to any thing Indian. His faith in non-violence was by no means typical of Hinduism—his predecessor in revolt, the able Maratha Brahman B.G. Tilak, and Gandhi's impatient lieutenant Subhas Chandra Bose, were far more orthodox in this respect. For Gandhi's pacifism we must look to the Sermon on the Mount and Tolstoy. His championing of women's rights is also the result of Western influence. In his social context, he was always rather an innovator than a conservative. Though some of his colleagues thought his programme of limited social reform too slow, he succeeded in shifting the whole emphasis of Hindu thought towards a popular and egalitarian social order, in place of the hierarchy of class and caste.

Following up the work of many less well-known 19th century reformers, Gandhi and his followers of the Indian National Congress have given new orientation and new life to Hindu culture, after centuries of stagnation.

93. Gandhi's faith in non-violence owed much to :

- (1) The influence of Tilak and Bose on him
- (2) Teachings of Hinduism
- (3) Sermon on the Mount and Tolstoy
- (4) Ancient Indian culture

94. 'He was an innovator rather than a conservative' means :

- (1) Gandhi had a programme of limited social reforms
- (2) He followed in the footsteps of 19th century Indian reformers
- (3) He gave a new orientation to Hindu culture
- (4) Even with his limited programme of social reform he shifted the whole emphasis of Hindu thought towards a popular and egalitarian social order

95. The dominant feature of his social reform programme was :

- (1) Giving new life to Hindu culture
- (2) His passionate love of the underdog and antipathy to caste
- (3) His love for ancient Indian culture
- (4) None of the above

96. Which of the following statements about gandhi is *not* true ?
- (1) He was the epitome of Hindu religion
 - (2) He believed in the fundamentals of Indian culture
 - (3) He worked for women's rights
 - (4) He was more unorthodox than Tilak and Bose in some of his views

Read the following paragraphs and answer the question nos. 97 to 100 :

In the world of incessant and feverish activity, we have little time to think, much less to consider ideals and objectives. Yet how are we to act, even in the present unless we know which way we are going and what our objectives are ? It is only in the peaceful atmosphere of a university that these basic problems can be adequately considered. It is only when the young men and women, who are in the university today and on whom the burden of life will fall tomorrow, learn to have clear objectives and standards of values that there is hope for the next generation. The past generation produced some great men but as a generation it led the world repeatedly to disaster. Two world wars are the price that has been paid for the lack of wisdom on man's part in this generation. It is a terrible

price and the tragedy of it is that, even after that price has been paid, we have not purchased real peace or a cessation of conflict and an even deeper tragedy is that mankind does not profit by its experience and continues to go the same way that led previously to disaster.

I think that there is a close and intimate relationship between the end we aim at and the means adopted to attain it. Even if the end is right but the means are wrong, it will vitiate the end or divert us in the wrong direction. Means and ends are thus intimately and inextricably connected and cannot be separated. That, indeed, has been the lesson of old taught us by many great men in the past, but unfortunately it is seldom remembered.

97. 'It is only in the peaceful atmosphere of a university that these basic problems can be adequately considered.' 'Basic problems' here refers to :

- (1) goals of life and standards of values
- (2) know ideals and objectives in life
- (3) need for wisdom in life
- (4) repeated disasters

98. We need ideals and objectives to :

- (1) allow great men to work fearlessly
- (2) save the world from disasters
- (3) ensure lasting peace in the world
- (4) understand that means are as important as the ends

99. We have not purchased real peace because :

- (1) There are many conflicts in the world today
- (2) Not everyone is happy with the peace we have today
- (3) It has been bought at a terrible price
- (4) Man has not learnt any lesson from his past experience

100. The author says 'The ends and the means are inextricably connected' to emphasize that :

- (1) One cannot exist without the other
- (2) The end justifies the means
- (3) Wrong means can achieve desirable but morally unacceptable ends
- (4) The end cannot be achieved unless there are means to achieve it

SERIES : 56

Test Booklet Serial No.

TEST-II

Number of Pages : 8

Time Allowed : 3 Hours

Number of Questions : 20

M.Marks : 100

The question paper consists of three parts, namely Part A, Part B, and Part C. Use separate answer-sheets to answer Part A, Part B, and Part C. Answer all questions in each part. Each question carries five marks.

PLEASE FILL IN THE FOLLOWING INFORMATION :

Name of the Candidate _____

Roll No. _____

Centre _____

Signature of the Candidate _____

Invigilator's Signature _____

IMPORTANT

Before starting the test please check the number of pages and number of questions. Faulty booklet, due to missing pages or missing questions or questions in duplicate or not in serial order or any other discrepancy, should be got replaced immediately by another booklet. No extra time will be given for this.

Part A**(Mathematics)**

1. Find the equation whose roots are n th powers of the roots of the equation :

$$x^2 - 2x \cos \theta + 1 = 0.$$

2. Find the eigenvalues and the corresponding eigenvectors of the matrix :

$$A = \begin{bmatrix} 2 & -3 \\ 2 & -5 \end{bmatrix}.$$

Also find a non-singular matrix P such that $P^{-1}AP$ is a diagonal matrix.

3. By considering the function f defined by

$$f(x) = (x - 2) \ln x, x \in [1, 2],$$

show that the equation $x(1 + \ln x) = 2$ is satisfied by at least one value of x lying between 1 and 2.

4. Find the line, on which the points of inflexion of the curve, $y^2 = (x - a)(x - b)^2$ lie.

5. Find the length of the loop of the curve :

$$x = t^2, y = t - \frac{1}{3}t^3.$$

6. Let a function f be defined as :

$$f(x) = \sqrt{x} \quad (2 \leq x \leq 3).$$

Is it continuous in $[2, 3]$? Is it uniformly continuous in $[2, 3]$? Justify your answer.

7. Let $f(x) = \begin{cases} \frac{x^3y}{x^2 + y^2}, & \text{when } x^2 + y^2 \neq 0 \\ 0, & \text{when } (x, y) = (0, 0) \end{cases}$

Prove or disprove :

$$f_{xy}(0, 0) = f_{yx}(0, 0).$$

8. Show that the functions, $e^x \sin x$ and $e^x \cos x$ are linearly independent.

Form the differential equation having these functions as independent solutions.

9. Solve the differential equation :

$$xy \, dx = zx \, dy + y^2 \, dz.$$

10. Identify the curve,

$$x^2 - y^2 - 4x + 8y - 21 = 0.$$

Also find its centre, foci and asymptotes.

11. Find the eccentricity and length of the latus rectum of the conic :

$$r = \frac{3}{2 - 2 \cos \theta}.$$

Also sketch its graph.

12. Forces act through the angular points of a Δ ABC, perpendicular to the opposite sides and are proportional to the cosines of the corresponding angles.

Show that their resultant, R, is proportional to :

$$\sqrt{1 - 8 \cos A \cos B \cos C}.$$

13. If X and Y are independent binomial variates, $B\left(5, \frac{1}{2}\right)$ and $B\left(7, \frac{1}{2}\right)$ respectively, show that :

$$P(X + Y = 3) = \frac{55}{2^{12}}.$$

14. Is $\operatorname{div}(\vec{f} \times \vec{g})$ equal to $\vec{g} \cdot \operatorname{curl} \vec{f} - \vec{f} \cdot \operatorname{curl} \vec{g}$? Prove or disprove.

Part B**(Computer Science)**

15. Write a program segment to find sum of every third element of an array of size n (starting index 0), e.g. for the array A : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, the sum would be $1 + 4 + 7 + 10 = 22$.
16. Simplify the Boolean function :
- $$f(x, y, z) = x'y'z + x'yz' + x'y'z + x'y'z'.$$
17. How many different Boolean functions of 3 variables are there ? Justify. (Assume that each variable takes values from the set {0, 1} and function values are also drawn from the set {0, 1}).
18. What will be output of the following C code ?

```
void main( ) {
    int i;
    for (i=0; i<=5; i++);
    i*=2;
    printf("%d", i);
    getch( );
}
```

19. What will be output of the following C code ?

```
extern int a;

void main( ) {
    int a=5;
    {
        int a=10;
        printf("%d", a++);
    }
    printf("%d", a);
    getch( );
}

int a=20;
```

Part C

(Communication Skills)

20. Read the passage below and answer the questions that follow :

What is a scientist's social duty towards this new world that he is creating ? This question is not easy or simple. The pure man of science

is concerned with the advancement of knowledge, and in his professional moments he takes it for granted that the advancement of knowledge is desirable. But inevitably he finds himself casting his pearls before swine. Men who do not understand his scientific work can utilize the knowledge that he provides. The new techniques to which it gives rise often have totally unexpected effects. The men who decide what use shall be made of the new techniques are not necessarily possessed of any exceptional degree of wisdom. They are mainly politicians whose professional skill consists in knowing how to play upon the emotions of the masses. The emotions which easily sway masses are very seldom the best of which the individuals composing the masses are capable. And so the scientist finds that he has unintentionally placed new powers in the hands of reckless men. He may easily come to doubt in moments of depression or overwork, whether the world would not be a happier place if science did not exist. He knows that science gives power and that the power which it gives could be used to increase human welfare; but he knows also that very often it is used, not so, but in the opposite direction.

- (i) Why is the knowledge that a scientist provides often misused ?
- (ii) Comment on the statement : '.....the power which it (science) gives could be used to increase human welfare, but he knows that very often it is used, not so, but in the opposite direction.'