

PHDKU18



Subject Code : **21-Mathematics**

તમને કહેવામાં ન આવે ત્યાં સુધી પ્રશ્નપુસ્તિકા ખોલવી નહીં.
Do not open the Question Booklet until ask to do so.



A

Booklet Sr. No.
1770569

ઉમેદવારનું નામ :

Candidates Name :

ઉમેદવારનો સીટ નંબર

ઉમેદવારની સહી

ખંડ નિરીક્ષકની સહી

સમય : 60 મિનિટ

કુલ પ્રશ્નો : 50

કુલ ગુણ : 100

ઉમેદવારોને સૂચના

- (1) આ પ્રશ્નપુસ્તિકામાં પ્રશ્ન ક્રમાંક 1-50 સુધી કુલ 50 પ્રશ્નો છે. પ્રત્યેક પ્રશ્નનો ઉત્તર (1), (2), (3) અને (4) પૈકી કોઈ એક છે. પ્રશ્નની સાથે જ ચારેય વિકલ્પો આપવામાં આવેલ છે. તમારે બધા જ પ્રશ્નોના ઉત્તર આપવાના છે. તમારે આ સાથે અલગ આપેલ ઉત્તરવહી (OMR SHEET)માં જ ઉત્તર આપવાના છે.

ઉદાહરણ તરીકે :

ભારતનું કયું રાજ્ય સૌથી લાંબો દરિયા-કિનારો ધરાવે છે ?

- (1) મહારાષ્ટ્ર (2) તામિલનાડુ
(3) ગુજરાત (4) આંધ્રપ્રદેશ

જવાબવહી (Answer Sheet)માં

① ② ● ④

ઉપર્યુક્ત ઉદાહરણમાં સારો જવાબ '3' છે. આથી '3'નું વર્તુળ કાળું (encode) કરેલ છે. ઉમેદવારોએ જવાબમાં "ગુજરાત" લખવું નહીં.

- (2) પ્રત્યેક પ્રશ્નના સાચા જવાબ માટે (2)બે ગુણ છે.
(3) આ પ્રશ્નપુસ્તિકામાં તમારે કશું જ લખવાનું નથી.
(4) સમય પૂર્ણ થયે પ્રશ્નપુસ્તિકા અને OMR ઉત્તરપત્ર સુપરવાઈઝરને પરત સોંપી દેવું.
(5) કસોટીની સમય મર્યાદા 60 મિનિટ છે.
(6) ઉમેદવારે વાદળી / કાળી બોલપોઈન્ટ પેનથી ઉત્તરો લખવાના છે. અન્ય શાહી, પેન કે પેન્સિલનો ઉપયોગ કરી શકાશે નહીં.

Instructions to Candidates

- (1) In this Test Booklet, there are Ques. No. 1-50, total 50 questions. The answer of each is any one out of (1), (2), (3) and (4). Four alternatives are given with the question. You have to answer all the questions. You have to answer on the **OMR Sheet** given separately to you.

For example :

Which state of India has the longest sea coast ?

- (1) Maharashtra (2) Tamilnadu
(3) Gujarat (4) Andra Pradesh

In answer sheet :

① ② ● ④

In the above example, the true answer is '3'. Hence, the circle of '3' is blackened (encoded) candidates should not write 'Gujarat' in the answer.

- (2) Each correct answer carries (2)Two marks.
(3) Do not write anything in this question paper.
(4) **Hand over Test Booklet and OMR Answer sheet to supervisor, after examination is over.**
(5) Time limit for this test is 60 minutes.
(6) Use **blue/black ball point pen** for filling responses in Answer Sheet. Any other ink, pen or Pencil is strictly prohibited.

પરીક્ષા પૂરી થયા બાદ પ્રશ્નપુસ્તિકા તથા OMR ઉત્તરવહી વર્ગ નિરીક્ષકને પરત કર્યા બાદ જ વર્ગમાં છોડવાનો રહેશે. તેમ કરવામાં કસૂર થયેથી શિક્ષકોને પગલાં ગણી પરીક્ષા માટે જે તે ઉમેદવારને ગેરલાયક ઠરાવવામાં આવશે.

1 Let G be a simple group of order 168. What is the number of subgroups of G order 7 ?

- (1) 1 (2) 7
(3) 8 (4) 28

2 If $f(x, y) = \begin{cases} xys \sin(1/x); & x \neq 0 \\ 0; & x = 0 \end{cases}$ then

- (1) $f_x(0, 0) = 1 = f_y(0, 0)$
(2) $f_x(0, 0) = 0 = f_y(0, 0)$
(3) $f_x(0, 0)$ and $f_y(0, 0)$ does not exist
(4) None of the above

3 Which of the following is not a solution of linear congruence $15x \equiv 6 \pmod{21}$?

- (1) 6 (2) 13
(3) 15 (4) 20

4 A person is known to hit the target in 3 out of 4 shots, whereas another person is known to hit the target in 2 out of 3 shots. Find the probability of the target being hit at all when they both try.

- (1) 11/12 (2) 2/11
(3) 5/7 (4) None

5 The remainder when $\sum_{r=1}^{1729} r!$ is divided by 12 is -

- (1) 6 (2) 7
(3) 8 (4) 9

6 If two regression coefficients are $-1/4$ and $-1/9$ the coefficient of correlation is -

- (1) $-1/6$ (2) $1/6$
(3) -6 (4) None

7 The rank of matrix $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 7 \end{bmatrix}$ is -

- (1) 1 (2) 2
(3) 3 (4) 4

8 The smallest 3 digit prime number is -

- (1) 101 (2) 103
(3) 109 (4) None of these

9 The second approximate solution of Differential Equation, $\frac{dy}{dx} = -xy$, with $y(0) = 1$ using Picard's method is -

- (1) $1 - \frac{x^2}{2} + \frac{x^4}{8}$ (2) $1 - \frac{x^2}{2} - \frac{x^4}{8}$
(3) $1 + \frac{x^2}{2} + \frac{x^4}{8}$ (4) None of these

10 The condition for convergent of Newton Raphson method for continuous function $f(x) = 0$ is -

- (1) $|f(x) \cdot f''(x)| < [f'(x)]^2$ (2) $|f(x) \cdot f'(x)| < [f''(x)]^2$
(3) $|f'(x) \cdot f''(x)| < [f(x)]^2$ (4) None of these

11 Euler – Lagrange equation for extremal of $\int_{x_1}^{x_2} f(x, y(x), y'(x)) dx$ is -

(1) $\frac{\partial f}{\partial y} - \frac{df}{dy} \left(\frac{\partial f}{\partial x} \right) = 0$

(2) $\frac{\partial f}{\partial y} + \frac{df}{dx} \left(\frac{\partial f}{\partial y} \right) = 0$

(3) $\frac{\partial f}{\partial x} + \frac{df}{dx} \left(\frac{\partial f}{\partial y} \right) = 0$

(4) $\frac{\partial f}{\partial y} - \frac{df}{dx} \left(\frac{\partial f}{\partial y} \right) = 0$

12 The eigen values of symmetric kernel are -

- (1) Real (2) Purely imaginary
(3) Complex (4) None of these

13 The resolvent kernel of the Volterra integral equation with kernel $k(x, t) = e^{x-t}$ is -

- (1) $e^{1+\lambda}$ (2) $e^{(x-t)(1+\lambda)}$
(3) $e^{(x-t)\lambda}$ (4) $e^{(x-t)(1-\lambda)}$

14 The total number of positive divisor of 50,000 is -

- (1) 20 (2) 30
(3) 40 (4) None

15 If $G = \{1, -1, i, -i\}$ is a multiplicative group, then how many elements of G have order 4 ?

- (1) 1 (2) 2
(3) 3 (4) 4

16 If G is an infinite cyclic group then number of generators of G will be -

- (1) Infinite (2) Exactly 1
(3) Exactly 2 (4) Can't say

17 If in a Markov Chain, the transition matrix has all zero elements in retention cells and all other elements are either zero or one, it is called -

- (1) unit (2) simple
(3) cyclic (4) None

18 G is a cyclic group of prime order p . Number of generators of G is -

- (1) p (2) p^2
(3) 2 (4) $p-1$

19 The partial differential equation for the equation $az + b = a^2x + y$, where a and b are arbitrary constant is -

- (1) $\frac{\partial z}{\partial x} = \frac{\partial z}{\partial y}$ (2) $\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$
(3) $\frac{\partial z}{\partial x} \cdot \frac{\partial z}{\partial y} = 1$ (4) None

20 If F is a field then the number of proper ideals in F is -

- (1) 0 (2) 1
(3) Infinite (4) None

- 21 If $f(x) = \begin{cases} 1; & \text{if } x \text{ is rational no.} \\ 0; & \text{if } x \text{ is irrational no.} \end{cases}$

then value of $(f \circ f) \sqrt{21}$ is -

- (1) 1 (2) 0
(3) $\sqrt{21}$ (4) None
- 22 The radius of convergence of series $\sum_{n=1}^{\infty} \frac{n!}{n^n}$ is -
- (1) 1 (2) e
(3) $1/e$ (4) 2
- 23 In a queuing theory, the process that customers move from one queue to another hoping to receive service more quickly is -
- (1) Balking (2) Reneging
(3) Jockeying (4) None
- 24 If I is a ring of integers, under usual addition and multiplication, then how many element(s) in I have multiplicative inverse ?
- (1) 0 (2) 2
(3) Infinite (4) None
- 25 The orthogonal trajectory of family of circles having centre origin is _____.
- (1) Family of lines parallel to X-axis
(2) Family of lines pass through origin
(3) Family of lines parallel to Y-axis
(4) Only X and Y-axis

- 26 The unit digit of number 7^{105} is -
- (1) 1 (2) 3
(3) 7 (4) 9
- 27 A list of short listed cricketers having 20 names includes five names of bowlers. If 3 names are selected out of 20 for a purpose, what is the probability that all are bowlers ?
- (1) $1/114$ (2) $3/20$
(3) $1/4$ (4) None
- 28 What is the probability of getting only 1 tail in 5 tosses of a coin ?
- (1) $1/5$ (2) $1/32$
(3) $5/32$ (4) None
- 29 The directional derivative of $f(x, y, z) = x^2yz$ in the direction $4i-3k$ at the point $(1, -1, 1)$ is -
- (1) 1 (2) -1
(3) $4/5$ (4) None
- 30 If A is an $n \times n$ symmetric matrix and it has exactly k (not necessarily distinct) eigen values then -
- (1) $n > k$ (2) $n < k$
(3) $n = k$ (4) None

31 The value of $(1 + \sqrt{3}i)^{90} + (1 - \sqrt{3}i)^{90}$ is _____.

- (1) 2^{91} (2) 2^{90}
(3) 0 (4) 2^{92}

32 The value of $\text{Log}_e(i)$ is _____.

- (1) $\pi/2$ (2) $-\pi/2$
(3) $-\pi i/2$ (4) $\pi i/2$

33 Which of the following function is analytic ?

- (1) $f(z) = |z|^2$ (2) $f(z) = 1/z$
(3) $f(z) = e^z$ (4) z^{10}

34 A subset 'A' of a set of real numbers R is compact iff -

- (1) A is closed and bounded
(2) A is open and bounded
(3) A is closed and unbounded
(4) None

35 If $i^2 = -1$ then $\sum_{n=0}^{20} i^n =$

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

36 The residue of $\frac{\sin z}{z^4 - 1}$ at $z = i$ is -

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

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

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

(4) $-\frac{\sinh 1}{4}$

37 Which of the following pair of functions is linearly dependent ?

(1) $f(x) = \cos x, g(x) = \sin x$

(2) $f(x) = e^x, g(x) = e^{-x}$

(3) $f(x) = 2^x, g(x) = 2^{x+2}$

(4) $f(x) = 2^x, g(x) = 3^x$

38 Particular solution of ODE $y'' + 4y = 3 \sin 2x$ is _____.

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

(2) $-\frac{3}{4} x \cos 2x$

(3) $\frac{3}{4} x \sin 2x$

(4) None

39 The regular singular point of ODE $x^3(x-1)y'' + 2(x-1)y' + 5xy = 0$ is _____.

(1) 0

(2) 1

(3) 2

(4) ∞

40 As per classification of partial differential equation, Laplace equation is -

(1) Parabolic

(2) Hyperbolic

(3) Elliptical

(4) None of these

41 If R is a ring of all 2×2 matrices with elements as integers and N is a set of all 2×2 matrices of the form $\begin{bmatrix} a & 0 \\ b & 0 \end{bmatrix}$ for integers a and b , then -

- (1) N is an ideal in R (2) N is a right ideal in R
(3) N is a left ideal in R (4) None

42 Which of the following is Clairaut form of P.D.E. ?

- (1) $z = px + qy + f(p, q)$ (2) $f(p, q) = 0$
(3) $f(p, q, z) = 0$ (4) $z = qx + py + f(p, q)$

43 The eigen values of Sturm-Liouville's Problem are always -

- (1) Real and non-negative (2) Complex
(3) Real and non-positive (4) None

44 The set of all limit point of the set $S = \left\{ \frac{1}{m} + \frac{1}{n}; m, n \in N \right\}$ is -

- (1) Φ (2) $\{0\}$
(3) $\left\{ \frac{1}{m}; m \in N \right\}$ (4) None

45 The series $\sum_{n=2}^{\infty} \frac{1}{(n(\log n)^p)}$ is -

- (1) Converges for $p > 1$ (2) Diverges for $p > 1$
(3) Converges for $0 < p < 1$ (4) None

- 46 The value of $\int_0^3 (x - [x])$ is _____.
- (1) $1/2$ (2) $3/2$
 (3) 0 (4) None
- 47 If in a graphical method to solve the linear programming problem (LPP), there are only two constraints and they are $2x + y \geq 3$ and $5x + 2.5y \leq 1$, then the LPP has -
- (1) Infinite solutions (2) No solution
 (3) Unbounded solution (4) None
- 48 If R is a ring such that $a^2 = a$ for each $a \in R$, then $a + a =$
- (1) a (2) 1
 (3) a^2 (4) 0
- 49 The characteristic of an integral domain cannot be
- (1) 0 (2) 2
 (3) 3 (4) 4
- 50 The equation $11^x + 13^x + 17^x - 19^x = 0$ has -
- (1) No real roots (2) Exactly two real roots
 (3) Only one real root (4) More than two real roots



SPACE FOR ROUGH WORK

