Seat No.

M.Phil./Ph.D. Entrance Examination, August - 2018
MATHEMATICS

Day and Date : Friday, 10 - 08 - 2018   **Total Marks : 100**
Time : 1.00 p.m. to 3.00 p.m.

Instructions :
1) All questions are compulsory.
2) Each question carries 2 marks.
3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
4) Use black ball point pen only for marking the circle. Do not make any stray mark on the OMR Answer Sheet.
5) Follow the instructions given on OMR Sheet.
6) Rough work shall be done on the sheet provided at the end of question paper.
7) Only non programmable calculators are allowed.

1) In the process of conducting research 'Formulation of Hypothesis" is followed by

A) Statement of Objectives   B) Analysis of Data

C) Selection of Research Tools   D) Collection of Data

2) Which one of the following is an indication of the quality of a research journal?

A) impact factor   B) h-index

C) g-index   D) i10-index

3) Which is the main objective of research?

A) To review the literature

B) To summarize what is already known

C) To get an academic degree

D) To discover new facts or to make fresh interpretation of known facts

P.T.O.

4) The research stream of immediate application is

   A) Conceptual research   B) Action research

   C) Fundamental research   D) Empirical research

5) Fundamental research reflects the ability to :

   A) Synthesize new ideals

   B) Expound new principles

   C) Evaluate the existing material concerning research

   D) Study the existing literature regarding various topics

6) Research ethics include

   A) punctuality   B) subjectivity

   C) integrity   D) smartness

7) An example of scientific knowledge is

   A) the authority of the prophet or great man

   B) social traditions and customs

   C) religious scriptures or notes

   D) laboratory and field experiments

8) The experimental study is based on the law of

   A) single variable

   B) replication

   C) occupation

   D) interest of the subject

9) Research is

    A) Searching again and again

    B) Finding solution to any problem

    C) Working in a scientific way to search for truth of any problem

    D) Deep study and expertise

10) A common test in research demands much priority on

    A) Reliability   B) Useability

    C) Objectivity   D) All of the above

11) Normal Probability Curve should be

    A) Positively skewed   B) Negatively skewed

    C) Leptokurtic skewed   D) Zero skewed

12) Which of the following are free symbols

e, c, h, A, B, C, G, ε

    A) A, B, C   B) *e, c, h,* G, *ε*

    C) A, B, C, G   D) *e, c, h,* A, G, *ε*

13) The unit of measurement of vertical size of type, is called _____.

    A) pica   B) point

    C) inch   D) mm

14) The following statement is due to _____.

"God exists since mathematics is consistent and the devil exits since we cannot prove it"

   A) E.Galoi   B) Weyl Herman

   C) Paul Cohen   D) Einstein

15) Which of the following is an EPW.

   A) This matrix is Toeplitz   B) This is Toeplitz matrix

   C) This is a Toeplitz matrix   D) This is the Toeplitz matrix

16) Marking for "*2–em* space" consists of _____ units.

   A) 12   B) 24

   C) 36   D) 48

17) Which of the following is an EPW.

   A) The matrix A is expressed as $A = UTV^T$

   B) A matrix A is expressed as $A = UTV^T$

   C) The matrix A is expressed as $A = UTV^T$

   D) The matrix A, is expressed as $A = UTV^T$

18) The input in LaTeX to yield $\int_0^1 \frac{x^2 dx}{\sqrt{1-x^2}}$ is

   A) $\displaystyle \int_0^1 \div{x^2 \, dx} {\sqroot{1-x^2}}$

   B) $\displaystyle \int_0^1 {x^2 \, dx} \div{\sqrt{1-x^2}}$

   C) $\displaystyle \int^0_1 \frac{x^2 \, dx} {\sqroot{1-x^2}}$

   D) $\displaystyle \int_0^1 \frac{x^2 \, dx} {\sqrt{1-x^2}}$

19) The command to inserts one inch of vertical space after the line in which it appears is

    A) \vspace*{1in}   B) \space*v{1in}

    C) \space*{1in}v   D) \v{1in}space*

20) The identity $R^j_{i\,kl} = -R^j_{ikl}$ can be obtained by typing

    A) $ R_i _{k1}^j = - R_j {}^{ik1} $

    B) $ R^j _i _{k1} = - R^j {}_ik1 $

    C) $ R_i {}^j{}_{k1} = - R^j {}_{ik1} $

    D) $ R_i ^{k1}^j = - R_{j^ik1}$

21) The input in LaTeX

$\begin{vmatrix} 0 & 1\\ 1 & 0 \end{vmatrix}$

yields

    A) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ B)

    C)

22) Scilab is _____.

    A) Open Source

    B) Commercial but cheaper than Matlab

    C) Commercial but cheaper than Maple

    D) Commercial but cheaper than mathematica

23) Files having the _____ extension contain both Scilab functions and executable statements.

    A)   B)

    C)   D)

24) Imaginary number i is represented in Scilab by using _____.

   A) I
   B) i
   C) imath
   D) %i

25) What will be the output of following Scilab commands?

   A = ones (3, 3); A (2 , :)

   A) 1 1 1
   B) 3 3 3
   C) 1 2 3
   D) 2 2 2

26)   where L is any rectifiable arc joining the points $z = a$ and $z = b$ is equal to

   A) $b-a$
   B) $|b-a|$
   C) arc length of L
   D) 0

27) The radius of convergence of the power series of the function

   about $z = 1/4$ is $\oint_L (dz) = (1-z)^{-1}$

   A) 1
   B) 1/4
   C) 3/4
   D) 0

28) Let $= \{\phi, \{a\}, \{b\}, \{a,b\}, \{c,d\}, \{a,c,d\}, \{b,c,d\}, X\}$ where $X = \{a,b,c,d\}$.
   Then which one of the following sets is a base for   .

   A) $\beta = \{\{a\}, \{b\}, \{c,d\}\}$
   B) $\beta = \{\{a\}, \{c\}, \{c,d\}\}$
   C) $\beta = \{\{c\}, \{b\}, \{c,d\}\}$
   D) $\beta = \{\{a\}, \{b\}\}$

29) Which of the following is true? A subset A of R^n is compact if:
   A) the complement of A is an open set
   B) A is connected and closed
   C) A is closed and bounded
   D) every limit point of A is in A

30) Which of the following statement is false?

    A) The product of two orthogonal matrices is orthogonal

    B) Inverse of a non-singular Hermitian matrix is Hermitian

    C) The product of two Hermitian matrices is Hermitian

    D) The product of two unitary matrices is unitary

31) In which of the following alternatives a subset T of a set

    $S = \{(2, 0, 0), (2, 2, 2), (2, 2, 0), (0, 2, 0)\}$ is not a basis of R^3 (R)?

    A) $T = \{(2, 0, 0), (2, 2, 0), (2, 2, 2)\}$

    B) $T = \{(2, 0, 0), (2, 2, 2), (0, 2, 0)\}$

    C) $T = \{(2, 0, 0), (2, 2, 0), (0, 2, 0)\}$

    D) $T = \{(2, 2, 0), (2, 2, 2), (0, 2, 0)\}$

32) Let G be a graph with 5 vertices v_1, v_2, v_3, v_4 and v_5 such that $d(v_1) = 3$, $d(v_2) = 4$, $d(v_3) = 3$, $d(v_4) = 3$, $d(v_5) = 1$ then the number edges in G are _____.

    A) 28   B) 14

    C) 7   D) 30

33) If $A(x) = 1 + x^3 + x^4 + x^8$ and $B(x) = 1 + x^4 + x^5 + x^8$ then the coefficient of x^8 in $A(x).B(x)$ is _____.

    A) 3   B) 4

    C) 5   D) 6

34) If Q is a field of rational numbers then _____.

   A) 2   B) 15
   C) 4   D) 6

35) A field of characteristic $p \neq 0$ is perfect if
   A) p^{th} root of any element of F is in F
   B) p^{th} power of any element of F is in F

   C)

   D) $a^{p^m} \in$ F for all positive integers m and for all $a \in$ F

36) The series _____, converges uniformly on_____.

   A) [0, 1]   B) [0, 1)
   C) (0, 1]   D)

37) For a vector field , the trace of the Jacobian matrix of   is _____.

   A) curl   B) grad

   C) div   D)

38) If G is a non abelian group of order p^3 where p is prime then $O(Z(G)) =$ _____.

   A) 3   B) p
   C) p^3 D) p^2

39) Let M be an R-module. Consider the following two statements.
   I)   Any intersection of submodules of M is a sub-module of M.
   II) Finite union of submodules of M is a sub-module of M.
   Then
   A) Only (I) is true   B) Only (II) is true
   C) Both (I) and (II) are true   D) Both (I) and (II) are false

40) All the eigen values of the matrix   lie in the interval

   A)   (–4, 6)   B)   (0, 8)

   C)   (–4, 8)   D)   (0, 6)

41) By trapezoidal rule

   A)   0.75   B)   .6944

   C)   ln 2   D)   log 2

42) For equation $x^3(x-1)y'' + (x-1)$ ... $= 0$.

   A) $x = 0$ is regular singular, $x = 1$ is irregular singular point.

   B) $x = 0, 1$ are irregular singular points.

   C) $x = 0, 1$ are regular singular points.

   D) $x = 0$ is irregular singular, $x = 1$ is regular singular point.

43) Indicial polynomial for the equation   is

   A) $r^2 + r - 1$ B) $r^2 - 1$

   C) $r^2 + 2r - 1$ D) $r^2 - r + 1$

44) If the constraints involved in the system are rheonomic then the kinetic energy is _____ function of generalized velocities.

A) quadratic but not homogeneous

B) quadratic and homogeneous

C) linear and homogeneous

D) cubic but not homogeneous

45) The system for which all the forces (except the forces of constraints) are derivable from a generalized scalar potential U is called _____.

A) conservative   B) monogenic

C) monotonic   D) scleronomic

46) Complete integral of PDE $p + q = $

A)   B)

C)   D)

47) Solution of the PDE   involving arbitrary constants a, b and c is

A)   B)

C)   D) $u = a^2 x + b^2 y + c^2 z + abc$

48) Let E = (1, 4], A = (1, 2], B = (2, 3), C = [3, 4]. Define $\phi = 2\chi_A + 4\chi_B + 5\chi_C$.

Then $\int_E \phi =$

A) 87   B) 44

C) 33   D) 11

49) Let E = (0, 1], and for each n, (n = 1, 2, 3, ...) define

$$f_n(x) = \begin{cases} 1 & \text{if } x \in \left(0, \dfrac{1}{n}\right), \\ 0 & \text{if } x \in \left[\dfrac{1}{n}, 1\right]. \end{cases}$$

Then $\lim\limits_{n\to\infty} \int_E f_n =$

A) 0   B) 1

C)   D) does not exists

50) A regular curve α is a reparametrization of a straight line if and only if _____.

A)   B)

C)   is tangent to   D)

⌘⌘⌘

Rough Work