NORTH- EASTERN HILL UNIVERSITY

MATHEMATICS DEPARTMENT

Shillong – 793022

Dt : 11.July.2017

MSc Mathematics Admission– 2017

This is to inform all the candidates who have applied for admission into the MSc (MATHEMATICS) programme of the department that the Entrance test for this purpose is scheduled to be held as follows:

1. Date of the Test : 26.July.2017, Wednesday.
2. Time : 11 am – 12 : 30 pm.
3. Venue : Top floor in Science Cluster Classrooms.

Important points to note:

a. Please see the subsequent pages of this notice for the model question paper.
b. Candidates are requested to familiarise themselves with the venue of the Entrance Test at least one day in advance so that they may not face any inconvenience on the day of the Test.
c. Reporting time will be at least one hour before the commencement of the Entrance Test.
d. Absence from the test on any ground will result in forfeiture of candidature for admission.
e. Candidates must bring valid ID in original and a passport size photograph.
f. Mobile phones will not be allowed during the duration of the Test.
g. Any act of indiscipline or misbehaviour will result in expulsion of the candidate.
h. For any further queries candidates may visit the department during office hours or call any of these numbers : 2722719, 9863607223, 9436161409, 9863020684.

11.7.2017

Convener Admission Committee 2017

John P J Kharbhih

M.Sc 2017 Entrance test

(Model question paper)

NAME : _____

Serial Number in Call letter : _____

Instructions:

Attempt all the questions. Each question may have 'NONE' or 'ONE' or 'MORE THAN ONE' correct options. Mark each option as either T or F (i.e. True or False). Credit in a question shall be given only on identification of 'All' the correct options. No partial credit shall be given in any circumstances. Each question fetches 5 marks. Question 1 is solved as an example for marking the answers.

(1) Mark each option as either True or False.

(a) Srinivasa Ramanujan is one of the celebrated Indian mathematicians who worked in the field of Number Theory. [T]

(b) The length of the circumference of a circle is always equal to $\pi * r^2$, where r is the radius of the cirlce. [F]

(c) 99 is a prime number. [F]

(d) $1 + 2 + 3 = 1 * 2 * 3$. [T]

(2) Let G be a cyclic group of order $n > 1$. Then

(a) there is an element of G whose order is $n - 1$. [ ]

(b) G has at least two generators. [ ]

(c) there is only isomorphism from G to G. [ ]

(d) there are n homomorphism from G to G. [ ]

(3) Let $f : \mathbb{R} \to \mathbb{R}$ be defined by $f(x) = \frac{|x-3|}{2}$. Then

(a) f is continuous at 2. [ ]

(b) f is differentiable at 0.☐

(c) f is differentiable at 3.☐

(d) f is continuous at 3.☐

(4) Let V be a vector space over $\mathbb{R}$ of dimension 1.

(a) V has only two subspaces.☐

(b) There are only finitely many one linear transformations from V to V.☐

(c) V has only one basis.☐

(d) If $T : V \to V$ is one-one linear transformation, then T is isomorphism.☐

(5) Let A, B, C, D be sets. Then

(a) $A \times (B - C) = (A \times B) - (A \times C)$.☐

(b) $A \times (B \cap C) = (A \times B) \cap (A \times C)$.☐

(c) $(A \cup B) \times (C \cup D) = (A \times C) \cup (B \times D)$.☐

(d) $(A \cap B) \times (C \cap D) = (A \times C) \cap (B \times D)$.☐

(6) Let X be a set and let $f : X \to Y$ be a map. Let A, B be subsets of X. Then

(a) $f(A \cup B) = f(A) \cup f(B)$.☐

(b) $f(A \cap B) = f(A) \cap f(B)$.☐

(c) $f(A - B) = f(A) - f(B)$.☐

(d) $f(f(A)) = f(A)$.☐

(7) Consider the ordinary differential equation $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 7y = 0$ on $\mathbb{R}$.

(a) The equation has only two solutions.☐

(b) There is only one solution y of the equation satisfying $y(2) = 5$☐.

(c) There is a solution y of the equation satisfying $y(0) = 1$ and $y(1) = 2$.☐

(d) Every solution of the equation is continuously differentiable function on $\mathbb{R}$.☐

(8) Let R be a commutative ring.

(a) If M is a maximal ideal of R, then M is a prime ideal of R.☐

(b) R has a subring which is a field.☐

(c) If P is a prime ideal, then P can not contain the multiplicative identity of R.☐

(d) If $f : R \to R$ is a ring homomorphism and M is a maximal ideal then $f(M)$ is a maximal ideal of R.☐

(9) Let $M_2(\mathbb{R})$ be the set of all 2×2 real matrices.

(a) $M_2(\mathbb{R})$ is a ring under usual matrix addition and multiplication.☐

(b) There are only finitely many elements $A \in M_2(\mathbb{R})$ such that $A^2 = A$.☐

(c) There are only finitely many elements $A \in M_2(\mathbb{R})$ such that $A^2 = I$, where I is the identity matrix.☐

(d) If $A \in M_2(\mathbb{R})$ such that $AB = BA$ for all $B \in M_2(\mathbb{R})$, then A is a scalar matrix.☐

(10) Let $\{x_n\}$ be a sequence in $\mathbb{R}$.

(a) If $\{x_n\}$ is bounded, then it is a convergence sequence.☐

(b) If $\{x_n\}$ is a convergence sequence, then it is bounded. ☐

(c) If $x_n = 5$ for all $n \geq 100$, then it is a convergence sequence.☐

(d) If $\{x_n\}$ is monotonically decreasing bounded below, then it is a convergence sequence. ☐

(11) Which of the following statements regarding open sets in $\mathbb{R}$ are True?

(a) A subset G of $\mathbb{R}$ is open in $\mathbb{R}$ if for each $x \in G$ there exists a neighborhood V of x such that $V \subseteq G$.☐

(b) The set $H = \{x \in \mathbb{R} | 0 < x < 1\}$ is open in $\mathbb{R}$.☐

(c) An arbitrary union of open subsets of $\mathbb{R}$ is also open in $\mathbb{R}$.☐

(d) The entire set $\mathbb{R} = (-\infty, \infty)$ is open in $\mathbb{R}$.☐

(12) Which of the following statements regarding compact sets are True?

(a) A subset K of $\mathbb{R}$ is compact if every open cover of K has a subcover.☐

(b) A subset K of $\mathbb{R}$ is compact if every cover of K has a finite subcover.☐

(c) A subset K of $\mathbb{R}$ is compact if every cover of K has an open finite subcover.☐

(d) A subset K of $\mathbb{R}$ is compact if every open cover of K has a finite subcover.☐

(13) Which of the following statements regarding continuous maps from $\mathbb{R}$ to $\mathbb{R}$ are True?

(a) If f, g are continuous, then $3f+5g$ is always continuous.☐

(b) Inverse image of a closed set under a continuous map is an open set.☐

(c) Continuous image of an open set is open.☐

(d) continuous image of a compact set is compact.☐

(14) Consider the following statements regarding coplanar forces.

(a) A system of coplanar forces acting in one plane at different points of a rigid body can be reduced to a single force through any given point and a single couple.☐

(b) A system of coplanar forces acting in one plane at different points of a rigid body can be reduced to two forces passing through two given point and a single couple.☐

(c) Any system of coplanar forces acting upon a rigid body can be reduced to either a single force or a single couple unless it is in equilibrium.☐

(d) If the sums of the resolved parts of the system of forces along any two perpendicular lines separately vanish, then the system of coplanar forces acting a rigid body will be in equilibrium.☐

(15) A bullet passes through a wall 10 cm thick and its velocity changes from 120 m/s to 80 m/s thereby.Then, the time required by the bullet to pass through the wall is

(a) 0.1 sec☐

(b) 1 sec☐

(c) 0.01 sec☐

(d) 0.001 sec☐

(16) A particle of mass m is always acted on by a force towards a fixed point, whose magnitude at a distance x from the point is $\frac{m\mu}{x^3}$. If it starts from rest at a distance c from the point, then the velocity at a distance $\frac{1}{2}c$

(a) $\frac{3\mu}{c}$☐

(b) $\sqrt{\frac{3\mu}{c}}$☐

(c) $\frac{\sqrt{3}\mu}{c}$☐

(d) $\frac{\sqrt{3\mu}}{c}$☐

(17) An integer a_n of the form $n^4 + 4$ is

(a) never a composite number.☐

(b) a composite only when n is prime.☐

(c) a composite number for all n.☐

(d) a composite number only when n is even.☐

(18) Consider the ordinary differential equation

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0.$$

(a) The equation is non-linear and it has a unique solution ϕ such that $\phi(0) = 1$ and $\phi'(0) = 3$.☐

(b) The equation is linear and it has a unique solution ϕ such that $\phi(0) = 1$ and $\phi'(0) = 3$.☐

(c) The equation is linear and it many solutions ϕ such that $\phi(0) = 1$ and $\phi'(0) = 3$.☐

(d) The equation is non-linear and it has many solutions ϕ such that $\phi(0) = 1$ and $\phi'(0) = 3$.☐

(19) The series $\sum_{n=0}^{\infty}(1 + (\frac{-1}{2})^n)$

(a) converges to 1☐

(b) is not convergent☐

(c) converges to 2☐

(20) The number of solutions to the equation $x^2 = 1$ in the ring $\mathbb{Z}_{10}$ (the ring of integers modulo 10) is

(a) exactly two.☐

(b) more than two.☐

(c) exactly one.☐

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