DEPARTMENT OF MATHEMATICS

NORTH-EASTERN HILL UNIVERSITY, SHILLONG-793022

Date : 22-12-2020

No. 1275

NOTICE

There will be an **ONLINE** entrance test for admission into Ph.D. programme in Mathematics on the 22nd January, 2021 from 11.00 a.m. to 12.30 p.m. Only those who score minimum 50% marks in the written test (5% concession for SC/ST/OBC (Non-creamy layer)) will be called for an interview which will be conducted through ONLINE mode on the 25th January 2021 from 12 p.m. onwards. Candidates found qualified for interview will be intimated through their respective emails. The list of eligible candidates and a model question paper is given below.

Thanking you.

Yours sincerely,

A. T. Singh

Head, Department of Mathematics
NEHU, Shillong-22.

Head
Department of Mathematics
North-Eastern Hill University
Shillong-793002

Contact numbers for further information:

1. Department of Mathematics: 0364-2722719.
2. Dr. A.T.Singh :- (O)0364-2722723, (M) 9863020684.
3. Dr. A.M.Buhphang :- (O) 0364-2722720, (M) 9436161409.
4. Dr. S.Dutta :- (O) 0364-2722718, (M) 9436104791.

LIST OF CANDIDATES ELIGIBLE TO APPEAR THE PH.D. ENTRANCE EXAMINATION IN MATHEMATICS DEPARTMENT, NEHU, SHILLONG SCHEDULED TO BE HELD ON 22-01-2021.

Sl.No.	Application No.	Name of the candidate
1	20100009	Bikash Choudhury
2	20100073-I	Theodore Copper Nicus Ch Marak
3	20100106	Longjaijai Kharkamni
4	20100118	Palash Nath
5	20100124	Gracelyne Nongdhar
6	20100180	Cyrille Coggan War
7	20100184	Lanuinla ozukum
8	20100194-I	Shrabanika Boruah
9	20100195	Md. Wahidur Rahaman
10	20100230-I	Gamseng K. Marak
11	20100231	Anil Singh
12	20100302-I	Simchera M Sangma
13	20100306-I	Damaphi Jyrwa
14	20100318-I	Susmita Dutta
15	20100319	Shiva Rao
16	20100322-I	Liza Tamuli
17	20100330	Arkiru Passah
18	20100393-I	Gitanjali Jyoti Miri
19	20100405-I	Amlan Jyoti Oza
20	20100453-I	Baptu Paul
21	20100466	Rupanjali
22	20101867	Metoka Narzary
23	20101876	Haniel Lyngdoh
24	20101907	Eveningstar Lyngdoh
25	20101968-I	Florence N Rabha
26	20102104	Techi Sumnya
27	20102159	Rituparna Saikia
28	20102260	Ibalarihun Roywan
29	20102314	Jahidul Islam
30	20102340	Jyoti Jyoti Kashyap
31	21100503	Mridusmita Hazarika
32	21100512	Pranjal Deka
33	21100532	Rishikesh Lal
34	21100556	Jharna Kalita
35	21100569	Pawan Kr Hajong
36	21100725	Partha Protim Gogoi
37	21100756	Seram Pritika Devi
38	21100763-I	Chinglensana Phanjoubam
39	21100782	Kaushik Kumar Sarmah
40	21100819	Himangshu Chakraborty
41	21100900	Firdous Ee Jannat
42	21100907	Indushri Patgiri

Contd.

Sl.No.	Application No.	Name of the candidate
43	21100910	Tekasangla
44	21100942	Biakkim KC
45	21100945	Silkam D. Sangma
46	21100954	Chaitanya Saikia
47	21100998	Joyprakash Maibam
48	21101028	Rashmirekha Pathak
49	21101044	Ruprekha Devi
50	21101046	Urboshi Hazarika
51	21101058	Nada Tado Tarung
52	21101064	Anannya Sagar Das
53	21101075-I	Sumon Bhowmick
54	21101091	Sourave Jyoti Borborah
55	21101148	Santosh Safi
56	21101223	Khusbu Kumari
57	21101263-I	Manbhalang Chyne
58	21101323	Everdith K Marak
59	21101356	Mary Basumatary
60	21101379	Swapnil Kalita
61	21101395	Gitartha Pratim Mahanta
62	21101538	Rajesh Prasad
63	21101592-I	Satchina R. Marak
64	21101612	Ruchika Baruah
65	21101618	Mrutyunjay Malik
66	21101625-I	Diganta Bordoloi
67	21101661	Synroplin Kharbani
68	21101662	Bhagyashree Saikia
69	21101678	Rezwana Farhin

A. T. Singh

Head, Department of Mathematics
NEHU, Shillong.

Department of Mathematics
North-Eastern Hill University
Shillong-793 022

DEPARTMENT OF MATHEMATICS
NEHU, SHILLONG
Ph.D. Model 2020

Marks : 100
Time : Two hours

Attempt any 5 *questions from Unit I and any* 6 *from Unit II.*

Unit I

(Each question of this unit carries 8 *marks.)*

State with justification whether the following are true or false.

1. The permutations (1 2 5 7) and (3 4 1 2 6) of S_7 are conjugate to each other.
2. Let (X, d) be a metric space and $F \subseteq X$ be a finite subset of X. Then F is closed in X.
3. $\underset{n\to\infty}{Lim}\left(1 - \frac{1}{n} + \frac{1}{n^3} - \frac{1}{n^4}\right)^n$ does not exist.
4. The number of prime ideals of the ring $\mathbb{Z}_5 \times \mathbb{Z}_7 \times \mathbb{Z}_{19}$ is exactly five.
5. There is a linear transformation $T : \mathbb{R}^2 \to \mathbb{R}^2$ such that $\ker T = \operatorname{im} T$.
6. If two $n \times n$ real matrices A and B have the same minimal polynomial then they are similar.
7. If $f : [0, 1] \to [0, 1]$ is continuous, then there exists some point $x_0 \in [0, 1]$ such that $f(x_0) = x_0$.
8. There exists a differentiable function $f : \mathbb{R} \to \mathbb{R}$ for which f' and f'' are continuous at $x = 1.5$ but f''' is not continuous at $x = 1.5$.
9. Let $f : X \to Y$ be a one-one map and let A, B be subsets of X. Then

$$(i)\ f(A \cap B) = f(A) \cap f(B) \quad (ii)\ f^{-1}(f(A)) = A.$$

10. Suppose a second order linear partial differential equation(PDE) is hyperbolic in a domain D, then it is also hyperbolic in another domain D_1.

Unit II

(Each question of this unit carries 10 *marks.)*

11. The group $\left\{ \begin{pmatrix} 1 & a & b \\ 0 & 1 & c \\ 0 & 0 & 1 \end{pmatrix} : a,\ b,\ c \in \mathbb{R} \right\}$ under matrix multiplication is known as the Heisenberg group. Find out the center of this group.

12. Let V be a finite dimensional vector space over a field $\mathbb{F}$. Let $\{e_1, \ldots, e_n\}$ be an ordered basis of V. Let $u = \sum_{i=1}^{n} a_i e_i,\ v = \sum_{i=1}^{n} b_i e_i,\ w = \sum_{i=1}^{n} c_i e_i \in V$, where $a_i, b_i, c_i \in \mathbb{F}$. Show that $\{u, v, w\}$ is linearly independent in V if and only if $\{(a_1, \ldots, a_n), (b_1, \ldots, b_n), (c_1, \ldots, c_n)\}$ is linearly independent in $\mathbb{F}^n$.

13. Find all solutions of the equation $y'' + 9y = \sin 3x$.

14. Show that every linear transformation $T : \mathbb{R}^n \to \mathbb{R}^m$ is continuous, where n, m are positive integers.

15. Determine all possible ring homomorphisms from $\mathbb{Q}$ to the matrix ring $M_2(\mathbb{Q})$.

16. Exhibit a field of order 125.

17. Find how many roots of the polynomial $f(z) = 2z^5 + 4z^2 + 1$ lie inside the disc $|z| < 1$ and how many lie on the real axis.

18. A band of 17 pirates stole a sack of gold coins. When they tried to divide the fortune into equal portions, 3 coins remained. In the ensuing brawl over who should get the extra coins, one pirate was killed. The wealth was redistributed, but this time an equal division left 10 coins. Again an argument developed in which another pirate was killed. But now the total fortune was evenly distributed among the survivors. What was the least number of coins that could have been stolen.

19. Prove that $4(29!) + 5!$ is divisible by 31.

20. Let A and B be two $n \times n$ real matrices such that AB is the identity matrix. Show that BA also the identity matrix.

21. Solve the equation $xu_x+(x+y)u_y = 1$ with initial condition $u(1, y) = y$. Is the solution defined everywhere?

22. Show that $\left\{ \frac{\sin \frac{n\pi}{2}}{n} : n \in \mathbb{N} \right\}$ is a compact subset of $\mathbb{R}$.

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