Department of Mathematics
Indian Institute of Technology Roorkee

No.: IITR/Math's/ Ph.D. Admission (SS/25-26) / Dated: November 12, 2025

Ph.D. Admission (Rolling & Spring Semester 2025–26)

The schedule for written test -

Date	**December 08, 2025**
Reporting Time	**9:00 A.M.**
Exam Time	**9:30 A.M.**

Important Instructions:

1. **The venue for the examination and accommodation-related information will be notified later on the department website.**
2. **No separate call letter/admit card will be sent to the candidates.**
3. **Applicants are advised to carefully check the department to which they have applied, as the Department of Mathematics and the Department of Applied Mathematics and Scientific Computing are two separate departments.**
4. Only those candidates who qualify the written examination will be allowed to appear for the interview.
5. **Candidates having their own valid fellowship (CSIR/UGC JRF/INSPIRE/DBT/ICMR, etc.) are required to produce proof at the time of the Written Test and/or interview.**
6. A copy of your project/dissertation/research articles (if any) may be produced at the time of the interview.
7. Other original documents/testimonials are not required at the time of the written test or interview.
8. **No request for change of date(s) and/or time for the Written Test or Interview will be entertained under any circumstances.**
9. Any sort of query to be addressed to the DRC Chairperson, Department of Mathematics, IIT Roorkee, Email – drc@ma.iitr.ac.in

Shortlisting Criteria: -

Minimum Eligibility	**Shortlisting Criteria**		
	Cutoff General	**Cutoff EWS/OBC**	**Cutoff SC/ST/PWD**
Masters in Mathematics with GATE (Marks)	**250**	**225**	**167**
Masters in Mathematics with JRF/NET (Marks)	**64**	**58**	**43**
Bachelors or Masters from IITs/CFTI with CGPA ≥ 8.0	**Minimum CGPA ≥ 8.00**		

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DRC Chairperson **Head of the Department**

List of Shortlisted Candidates for the written examination under Regular Advertisement

ROLL NUMBER	APPLICATION SEQUENCE NUMBER	DEPARTMENT APPLICATION NUMBER	NAME
MA001	PHDS25000996	MATS25000996	AARZOO
MA002	PHDS25000477	MATS25000477	AASTHA
MA003	PHDS25000124	MATS25000124	ABHINAV KUMAR
MA004	PHDS25000753	MATS25000753	ABHINAV SHARMA
MA005	PHDS25002877	MATS25002877	ABHISHEK KUMAR
MA006	PHDS25000376	MATS25000376	AJAY PAL SINGH
MA007	PHDS25001280	MATS25001280	AKANKSHA SINGH
MA008	PHDS25001210	MATS25001210	AKASH JAISWAL
MA009	PHDS25002653	MATS25002653	AKASH KUMAR
MA010	PHDS25002177	MATS25002177	AKHILESH DWIVEDI
MA011	PHDS25001304	MATS25001304	AKSHAR VASIYANI
MA012	PHDS25002298	MATS25002298	AMAN ALI MALITYA
MA013	PHDS25002381	MATS25002381	AMIT THENUA
MA014	PHDS25003718	MATS25003718	ANANYO MONDAL
MA015	PHDS25001906	MATS25001906	ANBARASAN S
MA016	PHDS25002219	MATS25002219	ANIMESH PRAMANIK
MA017	PHDS25005077	MATS25005077	ANJALI AWASTHI
MA018	PHDS25005770	MATS25005770	ANKAN HOSSAIN
MA019	PHDS25004418	MATS25004418	ANKESH PRATAP SINGH
MA020	PHDS25001235	MATS25001235	ANKIT CHAUHAN
MA021	PHDS25000787	MATS25000787	ANKIT KUMAR
MA022	PHDS25004721	MATS25004721	ANKIT KUMAR PRADHAN
MA023	PHDS25001558	MATS25001558	ANKIT SAROHA
MA024	PHDS25001827	MATS25001827	ANKITA
MA025	PHDS25002702	MATS25002702	ANKITA DAS
MA026	PHDS25001404	MATS25001404	ANKITA YADAV
MA027	PHDS25001460	MATS25001460	ANNU
MA028	PHDS25005102	MATS25005102	ANSH DEV MISHRA
MA029	PHDS25000389	MATS25000389	ANSHIKA
MA030	PHDS25001716	MATS25001716	ANSHIKA JAISWAL
MA031	PHDS25000024	MATS25000024	ANSHIKA YADAV
MA032	PHDS25002072	MATS25002072	ANURAG KUMAR SINGH
MA033	PHDS25001080	MATS25001080	ANURUDH KUMAR
MA034	PHDS25000050	MATS25000050	ANVESHAA TOMAR
MA035	PHDS25002719	MATS25002719	ARANYA SARKAR
MA036	PHDS25002607	MATS25002607	ARITRA DAS
MA037	PHDS25005973	MATS25005973	ASHISH GHITHALA
MA038	PHDS25006062	MATS25006062	ASHUTOSH
MA039	PHDS25002498	MATS25002498	ASHUTOSH JOSHI
MA040	PHDS25000037	MATS25000037	ASHUTOSH MAURYA
MA041	PHDS25001178	MATS25001178	ASHUTOSH MISHRA
MA042	PHDS25003749	MATS25003749	ASMI KHAN
MA043	PHDS25001228	MATS25001228	ATUL KUMAR PATEL

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ROLL NUMBER	APPLICATION SEQUENCE NUMBER	DEPARTMENT APPLICATION NUMBER	NAME
MA044	PHDS25000390	MATS25000390	AVNISH KUMAR
MA045	PHDS25000823	MATS25000823	AWANISH MISHRA
MA046	PHDS25001892	MATS25001892	AYASHKANT MOHAPATRA
MA047	PHDS25001206	MATS25001206	AYUSH
MA048	PHDS25005683	MATS25005683	AYUSHI SHARMA
MA049	PHDS25000668	MATS25000668	BHANU PRATAP SINGH
MA050	PHDS25003566	MATS25003566	BHARTI
MA051	PHDS25000965	MATS25000965	BHATT
MA052	PHDS25000333	MATS25000333	BHAVANA SINGH
MA053	PHDS25005364	MATS25005364	BHUPENDRA MANI
MA054	PHDS25005891	MATS25005891	BINOD PANDIT
MA055	PHDS25005354	MATS25005354	BINTU
MA056	PHDS25000345	MATS25000345	CHANDAN BARNWAL
MA057	PHDS25001023	MATS25001023	CHANDNI KUMARI
MA058	PHDS25002871	MATS25002871	CHESTA
MA059	PHDS25001499	MATS25001499	CHETAN DASS
MA060	PHDS25004935	MATS25004935	CHHAVI AGRAWAL
MA061	PHDS25003706	MATS25003706	DEBJIT MONDAL
MA062	PHDS25001247	MATS25001247	DEDIPYA CHATTARAJ
MA063	PHDS25005234	MATS25005234	DEEPAK BHATT
MA064	PHDS25000919	MATS25000919	DEEPAK KUMAR BEHERA
MA065	PHDS25005835	MATS25005835	DEEPAK YADAV
MA066	PHDS25002150	MATS25002150	DEEPTA ROY
MA067	PHDS25000945	MATS25000945	DEVANSH SHARMA
MA068	PHDS25004344	MATS25004344	DILIP KUMAR PARIHAR
MA069	PHDS25001372	MATS25001372	DINESH KUMAR
MA070	PHDS25005625	MATS25005625	DURGESH KUMAR
MA071	PHDS25001062	MATS25001062	GOUTAM BERA
MA072	PHDS25000824	MATS25000824	GURVACHAN SINGH
MA073	PHDS25003943	MATS25003943	HARENDRA SINGH
MA074	PHDS25000541	MATS25000541	HARSHIKA SAXENA
MA075	PHDS25000090	MATS25000090	HEMANGA JYOTI PARASAR
MA076	PHDS25003335	MATS25003335	HEMANT KUMAR
MA077	PHDS25001522	MATS25001522	INDERJEET
MA078	PHDS25004947	MATS25004947	INTESHAM ANSARI
MA079	PHDS25001302	MATS25001302	ISHA DAMANI
MA080	PHDS25001962	MATS25001962	ISHU DEV
MA081	PHDS25000319	MATS25000319	JAVED ALI
MA082	PHDS25004151	MATS25004151	JYOTI
MA083	PHDS25005611	MATS25005611	JYOTI VERMA
MA084	PHDS25004737	MATS25004737	JYOTIKA SA
MA085	PHDS25006012	MATS25006012	KAILASH JANGID
MA086	PHDS25001934	MATS25001934	KAJAL
MA087	PHDS25000725	MATS25000725	KALPANA
MA088	PHDS25004465	MATS25004465	KAMAL SHARMA

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ROLL NUMBER	APPLICATION SEQUENCE NUMBER	DEPARTMENT APPLICATION NUMBER	NAME
MA089	PHDS25001891	MATS25001891	KANCHAN DAS
MA090	PHDS25002645	MATS25002645	KANHAIYA PATEL
MA091	PHDS25000789	MATS25000789	KARTHIK V PAI
MA092	PHDS25002942	MATS25002942	KHUSHBOO MODY
MA093	PHDS25000570	MATS25000570	KHUSHI SINGH
MA094	PHDS25001776	MATS25001776	KM ANSHIKA GUPTA
MA095	PHDS25001200	MATS25001200	KM CHAITANYA VERMA
MA096	PHDS25005903	MATS25005903	KOKILAVANI K
MA097	PHDS25001114	MATS25001114	KORRA RATHAN
MA098	PHDS25005341	MATS25005341	KOUSIK KAR
MA099	PHDS25000709	MATS25000709	KRISHAN KANT VERMA
MA100	PHDS25005818	MATS25005818	KRISHNA KANTA MISRA
MA101	PHDS25005010	MATS25005010	KUNAL KAPOOR
MA102	PHDS25005972	MATS25005972	LALRINLIANA
MA103	PHDS25004807	MATS25004807	LOKESH
MA104	PHDS25000731	MATS25000731	MADHU
MA105	PHDS25005172	MATS25005172	MADHUMITA SABUI
MA106	PHDS25002698	MATS25002698	MANAV MANJEET SINGH
MA107	PHDS25000017	MATS25000017	MANJEET SINGH
MA108	PHDS25001053	MATS25001053	MD HUSAIN WARSI
MA109	PHDS25000629	MATS25000629	MOHD SUHEB
MA110	PHDS25001592	MATS25001592	MRIDUL CHAUDHARY
MA111	PHDS25004548	MATS25004548	MRITYUNJAI KM BHARTI
MA112	PHDS25000632	MATS25000632	MRITYUNJAY SINGH
MA113	PHDS25001299	MATS25001299	MUKESH KUMAR
MA114	PHDS25001885	MATS25001885	MUSHARAF ZAMIR
MA115	PHDS25000011	MATS25000011	NAMITA SINGH
MA116	PHDS25000815	MATS25000815	NANDANI MAURYA
MA117	PHDS25001794	MATS25001794	NAVEEN KUMAR MANDAL
MA118	PHDS25001268	MATS25001268	NEDUNURI SAI SRIVIDYA
MA119	PHDS25000220	MATS25000220	NEERAJ KUMARI
MA120	PHDS25004787	MATS25004787	NIKHIL KUMAWAT
MA121	PHDS25005041	MATS25005041	NIKHIL RAI
MA122	PHDS25001846	MATS25001846	NISHA BHARTI
MA123	PHDS25001784	MATS25001784	NISHU KUMAR
MA124	PHDS25003851	MATS25003851	PITAR MURARI
MA125	PHDS25000925	MATS25000925	POOJA
MA126	PHDS25005148	MATS25005148	POOJA YADAV
MA127	PHDS25000102	MATS25000102	POORNIMA GAUTAM
MA128	PHDS25001803	MATS25001803	PRADUMN MAURIYA
MA129	PHDS25004920	MATS25004920	PRAGHYA SHARMA
MA130	PHDS25000982	MATS25000982	PRAGYA SINGH
MA131	PHDS25000143	MATS25000143	PRAJESH KUMAR SHUKLA
MA132	PHDS25004994	MATS25004994	PRANAB SATVAYA
MA133	PHDS25004201	MATS25004201	PRANAV SINGHAL

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ROLL NUMBER	APPLICATION SEQUENCE NUMBER	DEPARTMENT APPLICATION NUMBER	NAME
MA134	PHDS25004626	MATS25004626	PRANSHU KOTHARI
MA135	PHDS25002074	MATS25002074	PRASHANT SINGH RATHORE
MA136	PHDS25003703	MATS25003703	PRATESH KUMAR
MA137	PHDS25000540	MATS25000540	PRATIKSHA RAI
MA138	PHDS25003270	MATS25003270	PRATYAY DATTA
MA139	PHDS25000225	MATS25000225	PRAVEEN
MA140	PHDS25004602	MATS25004602	PREETI
MA141	PHDS25005860	MATS25005860	PRIYADATTA BISWAL
MA142	PHDS25002025	MATS25002025	PRIYANKA DEY
MA143	PHDS25002451	MATS25002451	PRIYANSHI GOYAL
MA144	PHDS25001863	MATS25001863	PURBA MOULICK
MA145	PHDS25002172	MATS25002172	RAHUL BACHHAR
MA146	PHDS25006004	MATS25006004	RAHUL KUMAR
MA147	PHDS25005118	MATS25005118	RAHUL UZIR
MA148	PHDS25002203	MATS25002203	RAHUL YADAV
MA149	PHDS25000874	MATS25000874	RAJ KUMAR SHARMA
MA150	PHDS25004355	MATS25004355	RAJAT KUMAR
MA151	PHDS25002359	MATS25002359	RAJDEEP NANDI
MA152	PHDS25002319	MATS25002319	RAJEEV KUMAR
MA153	PHDS25003302	MATS25003302	RAJENDRA
MA154	PHDS25002833	MATS25002833	RAJPREET SINGH
MA155	PHDS25000807	MATS25000807	RAJU LAL REGAR
MA156	PHDS25001631	MATS25001631	RAMPATI KORI
MA157	PHDS25000860	MATS25000860	RASHMI BHARDWAJ
MA158	PHDS25002585	MATS25002585	RASHMI PANDEY
MA159	PHDS25001415	MATS25001415	RASHMI SINGH
MA160	PHDS25002678	MATS25002678	RAVI
MA161	PHDS25002225	MATS25002225	RENTU SK
MA162	PHDS25002433	MATS25002433	RIJU PATRA
MA163	PHDS25002883	MATS25002883	RISHABH GUPTA
MA164	PHDS25002071	MATS25002071	RISHABH SHUKLA
MA165	PHDS25005622	MATS25005622	RITIK KUMAR AGARWAL
MA166	PHDS25004377	MATS25004377	ROHIT KUMAR SINGH
MA167	PHDS25000091	MATS25000091	SABUJ BARAN SHIT
MA168	PHDS25001364	MATS25001364	SACHIN SINGH
MA169	PHDS25000805	MATS25000805	SAGNIK BANERJEE
MA170	PHDS25000188	MATS25000188	SAHIL BARMA
MA171	PHDS25003822	MATS25003822	SAKSHI SINGH
MA172	PHDS25002410	MATS25002410	SALONI
MA173	PHDS25001583	MATS25001583	SAMANWITA KARMAKAR
MA174	PHDS25004097	MATS25004097	SAMIKSHA
MA175	PHDS25000855	MATS25000855	SAMRIDDHA DAS
MA176	PHDS25002919	MATS25002919	SANDEEP KUMAR
MA177	PHDS25001043	MATS25001043	SANDESH SRIVASTAVA
MA178	PHDS25003044	MATS25003044	SANJAY SINGH MEHTA

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ROLL NUMBER	APPLICATION SEQUENCE NUMBER	DEPARTMENT APPLICATION NUMBER	NAME
MA179	PHDS25001039	MATS25001039	SATYAM PANDEY
MA180	PHDS25003420	MATS25003420	SATYENDRA NATH
MA181	PHDS25000685	MATS25000685	SAUMYARANJAN DAS
MA182	PHDS25000296	MATS25000296	SHALU SRIVASTAVA
MA183	PHDS25004532	MATS25004532	SHANTA ROY
MA184	PHDS25002069	MATS25002069	SHEETAL JAUHARI
MA185	PHDS25002641	MATS25002641	SHEIKH SADIYA NAZIR
MA186	PHDS25000921	MATS25000921	SHIVA GANGWAR
MA187	PHDS25004738	MATS25004738	SHIVAM GOEL
MA188	PHDS25000778	MATS25000778	SHIVAM RAJPOOT
MA189	PHDS25000791	MATS25000791	SHIVANI
MA190	PHDS25005577	MATS25005577	SHIVANI SHRIVASTAVA
MA191	PHDS25000246	MATS25000246	SHIVANSHU SHUKLA
MA192	PHDS25001572	MATS25001572	SHRADHANJALI SAHOO
MA193	PHDS25004953	MATS25004953	SHREE MOHAPATRA
MA194	PHDS25002087	MATS25002087	SHRUTI JOSHI
MA195	PHDS25000730	MATS25000730	SHRUTI NILESH SHAH
MA196	PHDS25001698	MATS25001698	SHUBHAM TRIPATHI
MA197	PHDS25001306	MATS25001306	SHUVAM BANERJEE
MA198	PHDS25005355	MATS25005355	SIDDHARTH VASISHTH
MA199	PHDS25001742	MATS25001742	SNEHASMITA NANDA
MA200	PHDS25001806	MATS25001806	SNEHASMITA SAHU
MA201	PHDS25004773	MATS25004773	SOHINI MANDAL
MA202	PHDS25005921	MATS25005921	SONA KANWAR
MA203	PHDS25000553	MATS25000553	SONAM KUMARI
MA204	PHDS25005744	MATS25005744	SORAJ CHANDRA PATEL
MA205	PHDS25001216	MATS25001216	SOUMAK MAJUMDER
MA206	PHDS25004629	MATS25004629	SOUMYA SANKAR JANA
MA207	PHDS25004642	MATS25004642	SOURAV PRAMANIK
MA208	PHDS25001409	MATS25001409	SUBASH M
MA209	PHDS25001810	MATS25001810	SUBHENDU SEKHAR TRIPATHY
MA210	PHDS25003965	MATS25003965	SUCHARITA SAHOO
MA211	PHDS25002244	MATS25002244	SUDESHNA GOSWAMI
MA212	PHDS25002608	MATS25002608	SUDHA
MA213	PHDS25002415	MATS25002415	SUKANTA GHANTA
MA214	PHDS25000840	MATS25000840	SUMAN PARUI
MA215	PHDS25002495	MATS25002495	SUPRIYA
MA216	PHDS25002429	MATS25002429	SURAJ YADAV
MA217	PHDS25001051	MATS25001051	SURAJIT ADAK
MA218	PHDS25002642	MATS25002642	SURBHI MITTAL
MA219	PHDS25005243	MATS25005243	SURESH MONDAL
MA220	PHDS25001786	MATS25001786	SURYA PRATAP SINGH
MA221	PHDS25001153	MATS25001153	SWAPNEEL
MA222	PHDS25005137	MATS25005137	SWATI TOMER
MA223	PHDS25001858	MATS25001858	T DELHIGANESH

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ROLL NUMBER	APPLICATION SEQUENCE NUMBER	DEPARTMENT APPLICATION NUMBER	NAME
MA224	PHDS25001479	MATS25001479	TANAYA ARANDHARA
MA225	PHDS25002259	MATS25002259	TIYAS CHAKRABORTTY
MA226	PHDS25001226	MATS25001226	TUHIN SARKAR
MA227	PHDS25002497	MATS25002497	TUSHAR SATISHBHAI HEMANI
MA228	PHDS25000943	MATS25000943	UDAY PRATAP GANGWAR
MA229	PHDS25003701	MATS25003701	UGENDRAN R
MA230	PHDS25003204	MATS25003204	UPENDRA AHIRWAR
MA231	PHDS25002828	MATS25002828	VAGEESH MISHRA
MA232	PHDS25002909	MATS25002909	VAISHNAVI SHUKLA
MA233	PHDS25000285	MATS25000285	VANDANA
MA234	PHDS25005269	MATS25005269	VANSH VERMA
MA235	PHDS25000726	MATS25000726	VANSHIKA
MA236	PHDS25000346	MATS25000346	VINAY TIWARI
MA237	PHDS25004594	MATS25004594	VINEET KUMAR
MA238	PHDS25001055	MATS25001055	VISHAL KUMAR JHA
MA239	PHDS25000569	MATS25000569	VISHAL SAMI
MA240	PHDS25001690	MATS25001690	VISHVAJEET MAHENDRA RAI
MA241	PHDS25001199	MATS25001199	VISHWAJEET
MA242	PHDS25001564	MATS25001564	VIVEK KUMAR
MA243	PHDS25002763	MATS25002763	YASH CHAWDA`
MA244	PHDS25000812	MATS25000812	YASHJEET PRATAP SINGH
MA245	PHDS25003520	MATS25003520	YASHWANI
MA246	PHDS25002293	MATS25002293	YOGESH KOSTHA

List of Shortlisted Candidates for the written examination under Rolling Advertisement

ROLL NUMBER	APPLICATION SEQUENCE NUMBER	DEPARTMENT APPLICATION NUMBER	NAME
RA001	PHDR2501547	MATR2501547	ADITYA PRASAD SAHU
RA002	PHDR2502043	MATR2502043	ADITYA TAMANG
RA003	PHDR2501133	MATR2501133	AKASH KUMAR PATEL
RA004	PHDR2501948	MATR2501948	AKSHAY KUMAR
RA005	PHDR2501919	MATR2501919	AMAN KUMAR
RA006	PHDR2501977	MATR2501977	ANKITA YADAV
RA007	PHDR2501025	MATR2501025	ANSHIKA
RA008	PHDR2502006	MATR2502006	APARNA GUPTA
RA009	PHDR2500969	MATR2500969	ASHISH
RA010	PHDR2501080	MATR2501080	ASHISH KUMAR
RA011	PHDR2501981	MATR2501981	ASHUTOSH SEN
RA012	PHDR2501987	MATR2501987	AVNISH KUMAR
RA013	PHDR2502001	MATR2502001	BHASWATI BHUNIA
RA014	PHDR2501665	MATR2501665	INDERJEET
RA015	PHDR2501990	MATR2501990	JABER ALI MOLLA
RA016	PHDR2500869	MATR2500869	JYOTI KUMARI

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ROLL NUMBER	APPLICATION SEQUENCE NUMBER	DEPARTMENT APPLICATION NUMBER	NAME
RA017	PHDR2501373	MATR2501373	KAMALKANT
RA018	PHDR2501978	MATR2501978	KHUSHI GARG
RA019	PHDR2501883	MATR2501883	MANAV MANJEET SINGH
RA020	PHDR2501932	MATR2501932	MANDA VINAYAK HATWAR
RA021	PHDR2501012	MATR2501012	MANJEET SINGH
RA022	PHDR2501309	MATR2501309	NEETU
RA023	PHDR2501827	MATR2501827	PRADUMN MAURIYA
RA024	PHDR2500913	MATR2500913	PRANSHU KOTHARI
RA025	PHDR2502037	MATR2502037	PRIYANKA DEY
RA026	PHDR2501903	MATR2501903	PURSOTTAM
RA027	PHDR2501926	MATR2501926	RAHUL YADAV
RA028	PHDR2501572	MATR2501572	RANJEET SAWAN
RA029	PHDR2501889	MATR2501889	RASHMI SINGH
RA030	PHDR2501426	MATR2501426	RAVI
RA031	PHDR2501032	MATR2501032	RAVINA
RA032	PHDR2501310	MATR2501310	SALONI JAIN
RA033	PHDR2501028	MATR2501028	SAPTARSHI DEY
RA034	PHDR2500841	MATR2500841	SARIKA
RA035	PHDR2502017	MATR2502017	SAYAK DE BHOWMIK
RA036	PHDR2500804	MATR2500804	SHAILENDRA PRAKASH MISHRA
RA037	PHDR2501920	MATR2501920	SHANTI LAL MEENA
RA038	PHDR2501341	MATR2501341	SHREERAM SHARMA
RA039	PHDR2502042	MATR2502042	SHRESTHA BASU
RA040	PHDR2500895	MATR2500895	SIMRAN KAUR
RA041	PHDR2501523	MATR2501523	SUMAN MANDAL
RA042	PHDR2501498	MATR2501498	SURYA PRATAP SINGH
RA043	PHDR2501761	MATR2501761	SWEETY KUMARI
RA044	PHDR2501515	MATR2501515	VANDANA
RA045	PHDR2501444	MATR2501444	YASH CHAWDA
RA046	PHDR2501971	MATR2501971	ZEELKUMAR MANUBHAI KHOKHARIYA

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DRC Chairperson

12/11/2025

Head of the Department

SYLLABUS FOR WRITTEN TEST AND INTERVIEW

- **Each candidate must choose either Syllabus I or Syllabus II.**

SYLLABUS I

Calculus: Functions of two or more variables, continuity, directional derivatives, partial derivatives, total derivative, maxima and minima, saddle point, method of Lagrange's multipliers; Double and Triple integrals and their applications to area, volume and surface area; Vector Calculus: gradient, divergence and curl, Line integrals and Surface integrals, Green's theorem, Stokes' theorem, and Gauss divergence theorem.

Linear Algebra: Finite dimensional vector spaces over real or complex fields; Linear transformations and their matrix representations, rank and nullity; systems of linear equations, characteristic polynomial, eigenvalues and eigenvectors, diagonalization, minimal polynomial, Cayley-Hamilton Theorem, Finite dimensional inner product spaces, Gram- Schmidt orthonormalization process, symmetric, skew-symmetric, Hermitian, skew- Hermitian, normal, orthogonal and unitary matrices; diagonalization by a unitary matrix, Jordan canonical form; bilinear and quadratic forms.

Real Analysis: Metric spaces, connectedness, compactness, completeness; Sequences and series of functions, uniform convergence, Ascoli-Arzela theorem; Weierstrass approximation theorem; contraction mapping principle, Power series; Differentiation of functions of several variables, Inverse and Implicit function theorems; Lebesgue measure on the real line, measurable functions; Lebesgue integral, Fatou's lemma, monotone convergence theorem, dominated convergence theorem.

Complex Analysis: Functions of a complex variable: continuity, differentiability, analytic functions, harmonic functions; Complex integration: Cauchy's integral theorem and formula; Liouville's theorem, maximum modulus principle, Morera's theorem; zeros and singularities; Power series, radius of convergence, Taylor's series and Laurent's series; Residue theorem and applications for evaluating real integrals; Rouche's theorem, Argument principle, Schwarz lemma; Conformal mappings, Mobius transformations.

Ordinary Differential Equations: First order ordinary differential equations, existence and uniqueness theorems for initial value problems, linear ordinary differential equations of higher order with constant coefficients; Second order linear ordinary differential equations with variable coefficients; Cauchy-Euler equation, method of Laplace transforms for solving ordinary differential equations, series solutions (power series, Frobenius method); Legendre and Bessel functions and their orthogonal properties; Systems of linear first order ordinary differential equations, Sturm's oscillation and separation theorems, Sturm-Liouville eigenvalue problems, Planar autonomous systems of ordinary differential equations: Stability of stationary points for linear systems with constant coefficients, Linearized stability, Lyapunov functions.

Algebra: Groups, subgroups, normal subgroups, quotient groups, homomorphisms, automorphisms; cyclic groups, permutation groups, Group action, Sylow's theorems and their applications; Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domains, Principle ideal domains, Euclidean domains, polynomial rings, Eisenstein's irreducibility criterion; Fields, finite fields, field extensions, algebraic extensions, algebraically closed fields.

Aganguli

DRC Chairperson **Head of the Department**

Functional Analysis: Normed linear spaces, Banach spaces, Hahn-Banach theorem, open mapping and closed graph theorems, principle of uniform boundedness; Inner-product Organizing Institute spaces, Hilbert spaces, orthonormal bases, projection theorem, Riesz representation theorem, spectral theorem for compact self-adjoint operators**.**

Numerical Analysis: Systems of linear equations: Direct methods (Gaussian elimination, LU decomposition, Cholesky factorization), Iterative methods (Gauss-Seidel and Jacobi) and their convergence for diagonally dominant coefficient matrices; Numerical solutions of nonlinear equations: bisection method, secant method, Newton-Raphson method, fixed point iteration; Interpolation: Lagrange and Newton forms of interpolating polynomial, Error in polynomial interpolation of a function; Numerical differentiation and error, Numerical integration: Trapezoidal and Simpson rules, Newton-Cotes integration formulas, composite rules, mathematical errors involved in numerical integration formulae; Numerical solution of initial value problems for ordinary differential equations: Methods of Euler, Runge-Kutta method of order 2.

Partial Differential Equations: Method of characteristics for first order linear and quasilinear partial differential equations; Second order partial differential equations in two independent variables: classification and canonical forms, method of separation of variables for Laplace equation in Cartesian and polar coordinates, heat and wave equations in one space variable; Wave equation: Cauchy problem and d'Alembert formula, domains of dependence and influence, non-homogeneous wave equation; Heat equation: Cauchy problem; Laplace and Fourier transform methods.

Topology: Basic concepts of topology, bases, subbases, subspace topology, order topology, product topology, quotient topology, metric topology, connectedness, compactness, countability and separation axioms, Urysohn's Lemma.

Linear Programming: Linear programming models, convex sets, extreme points; Basic feasible solution, graphical method, simplex method, two phase methods, revised simplex method ; Infeasible and unbounded linear programming models, alternate optima; Duality theory, weak duality and strong duality; Balanced and unbalanced transportation problems, Initial basic feasible solution of balanced transportation problems (least cost method, north-west corner rule, Vogel's approximation method); Optimal solution, modified distribution method; Solving assignment problems, Hungarian method.

<u>SYLLABUS II</u>

Calculus: Finite, countable and uncountable sets; Real number system as a complete ordered field, Archimedean property; Sequences of real numbers, convergence of sequences, bounded sequences, monotonic sequences, Cauchy criterion for convergence; Series of real numbers, convergence, tests of convergence, alternating series, absolute and conditional convergence; Power series and radius of convergence; Functions of a real variable: Limit, continuity, monotone functions, uniform continuity, differentiability, Rolle's theorem, mean value theorems, Taylor's theorem, L'Hospital rules, maxima and minima, Riemann integration and its properties, improper integrals; Functions of several real variables: Limit, continuity, partial derivatives, directional derivatives, gradient, Taylor's theorem, total derivative, maxima and minima, saddle point, method of Lagrange multipliers, double and triple integrals and their applications.

Matrix Theory: Subspaces of $\mathbb{R}n$ and $\mathbb{C}n$, span, linear independence, basis and dimension, row space and column space of a matrix, rank and nullity, row reduced echelon form, trace and determinant, inverse of a matrix, systems of linear equations; Inner products in $\mathbb{R}n$ and $\mathbb{C}n$, Gram Schmidt orthonormalization; Eigen values and eigen vectors, characteristic polynomial, Cayley Hamilton theorem, symmetric, skew-symmetric, Hermitian, skew-Hermitian, orthogonal, unitary matrices and their eigen values, change of basis matrix, equivalence and similarity, diagonalizability, positive

Aganguli

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definite and positive semi-definite matrices and their properties, quadratic forms, singular value decomposition.

Probability: Axiomatic definition of probability, properties of probability function, conditional probability, Bayes' theorem, independence of events; Random variables and their distributions, distribution function, probability mass function, probability density function and their properties, expectation, moments and moment generating function, quantiles, distribution of functions of a random variable, Chebyshev, Markov and Jensen inequalities.
Standard Discrete and Continuous Univariate Distributions: Bernoulli, binomial, geometric, negative binomial, hypergeometric, discrete uniform, Poisson, continuous uniform, exponential, gamma, beta, Weibull, normal. Jointly distributed random variables and their distribution functions, probability mass function, probability density function and their properties, marginal and conditional distributions, conditional expectation and moments, product moments, simple correlation coefficient, joint moment generating function, independence of random variables, functions of random vector and their distributions, distributions of order statistics, joint and marginal distributions of order statistics; multinomial distribution, bivariate normal distribution, sampling distributions: central, chi-square, central t, and central F distributions. Convergence in distribution, convergence in probability, convergence almost surely, convergence in r-th mean and their inter-relations, Slutsky's lemma, Borel-Cantelli lemma; weak and strong laws of large numbers; central limit theorem for i.i.d. random variables, delta method.

Stochastic Processes: Markov chains with finite and countable state space, classification of states, limiting behaviour of n-step transition probabilities, stationary distribution, Poisson process, birth and-death process, pure-birth process, pure-death process, Brownian motion and its basic properties.

Estimation: Sufficiency, minimal sufficiency, factorization theorem, completeness, completeness of exponential families, ancillary statistic, Basu's theorem and its applications, unbiased estimation, uniformly minimum variance unbiased estimation, Rao-Blackwell theorem, Lehmann Scheffe theorem, Cramer-Rao inequality, consistent estimators, method of moments estimators, method of maximum likelihood estimators and their properties; Interval estimation: pivotal quantities and confidence intervals based on them, coverage probability.

Testing of Hypotheses: Neyman-Pearson lemma, most powerful tests, monotone likelihood ratio (MLR) property, uniformly most powerful tests, uniformly most powerful tests for families having MLR property, uniformly most powerful unbiased tests, uniformly most powerful unbiased tests for exponential families, likelihood ratio tests, large sample tests.

Non-parametric Statistics: Empirical distribution function and its properties, goodness of fit tests, chi-square test, Kolmogorov-Smirnov test, sign test, Wilcoxon signed rank test, Mann Whitney U-test, rank correlation coefficients of Spearman and Kendall.

Multivariate Analysis: Multivariate normal distribution: properties, conditional and marginal distributions, maximum likelihood estimation of mean vector and dispersion matrix, Hotelling's T2 test, Wishart distribution and its basic properties, multiple and partial correlation coefficients and their basic properties.

Regression Analysis: Simple and multiple linear regression, R2 and adjusted R2 and their applications, distributions of quadratic forms of random vectors: Fisher-Cochran theorem, Gauss Markov theorem, tests for regression coefficients, confidence intervals.

AGanguli 12/11/2025

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