JAIPUR NATIONAL UNIVERSITY

A venture of The Seedling Group of Educational Institutions

Master of Science - Mathematics
(M.Sc. - Mathematics)

Distance Mode

PROGRAM PROJECT REPORT – M.SC - Mathematics

Contents

M.SC - Mathematics

1. Program Overview

1.1 Program's Mission and Objectives

The mission of the M.Sc Mathematics program is to provide students with a comprehensive education in advanced mathematical concepts, theories, and methodologies, preparing them for careers in academia, industry, or research. The program aims to cultivate a strong foundation in mathematical principles while promoting intellectual curiosity, creativity, and lifelong learning.

Program Objectives:

1. Advanced Knowledge: To equip students with advanced knowledge and understanding of various branches of mathematics, including but not limited to algebra, analysis, topology, geometry, and applied mathematics.

2. Critical Thinking: To develop students' ability to think critically and analytically about mathematical problems, concepts, and theories, enabling them to formulate and solve complex mathematical problems.

3. Research Skills: To foster research skills in students, including the ability to review literature, formulate research questions, design experiments, collect and analyze data, and draw meaningful conclusions, culminating in a thesis or research project.

4. Communication: To enhance students' communication skills, both written and oral, enabling them to effectively communicate mathematical ideas, results, and conclusions to diverse audiences, including peers, experts, and the general public.

5. Application of Mathematics: To demonstrate the application of mathematical concepts and techniques to real-world problems in various fields, such as physics, engineering, computer science, economics, and finance.

6. Interdisciplinary Perspective: To encourage interdisciplinary collaboration and application of mathematical methods to address problems in other disciplines, fostering innovation and creativity.

7. Ethical Conduct: To instil ethical values and professional integrity in students, emphasizing honesty, rigor, and accountability in their academic and professional endeavours.

8. Professional Development: To provide opportunities for professional development, including seminars, workshops, conferences, and internships, to prepare students for successful careers in academia, industry, or research.

9. Continued Learning: To promote lifelong learning and professional growth among graduates, encouraging them to stay updated with the latest developments in mathematics and related fields through self-directed study, continuing education programs, and participation in professional societies.

By aligning the curriculum, teaching methodologies, and assessment practices with these objectives, the M.Sc Mathematics program aims to produce graduates who are well-equipped to make significant contributions to the advancement of mathematics and its applications in the broader context of society.

1.2 Relevance of the Program with JNU's Vision and Mission

Jaipur National University (JNU) was established in 2007. JNU provides a world-class learning experience, with a highly accomplished faculty, numerous extracurricular activities, and a wide range of academic pursuits. The university fosters holistic development of students.

JNU with its vision to transform the Education Landscape of India and contribute to the maximum to improve the GER of India has plans to launch affordable and flexible education programs. Distance programs is an excellent way to launch affordable and flexible education programs in sync with the vision and mission of the university stated below:

University Vision:

To be a leader in creating unique and exclusive learning opportunities in all disciplines of study that ultimately lead to the advancement of learning and creation of a sustainable society and environment.

University Mission:

- Provide global opportunities of learning through broad and balanced academic programmes.
- Explore and hone the potential of stakeholders, develop their human and intellectual capacities to the fullest.
- Create and maintain excellence with high standard driven activities, universal significance and acknowledgement.
- Inculcate and keep track of the current trends and finest practices in education for constant growth and evolution.

1.3 Nature of Prospective Target Group of Students

The curriculum of M.Sc - MATHEMATICS is designed in such a way that it helps the students to become not only more employable but also encourage them to become entrepreneurs. Primarily the target group of learners will be:

- Population living in remote areas where higher education institutes are not easily accessible.
- Learners who could not get admission in the regular mode due to limited intake capacity.
- Learners who are working and who desire to pursue higher education as a means for movement up the ladder.
- Learners who are unable to pursue Higher education due to social, financial and economic compulsions as well as demographic reasons.

1.4 Appropriateness of programs to be conducted in Distance mode to acquire specific skills and competence

The significance of the M.Sc Mathematics program lies in its ability to equip students with advanced mathematical knowledge and analytical skills, making them highly sought after in various industries and sectors. This program provides a deep understanding of mathematical principles, theories, and techniques, which are essential for solving complex problems in fields such as finance, engineering, computer science, and more. Graduates of this program are well-prepared for careers in research, academia, data

analysis, cryptography, and numerous other areas where expertise in mathematics is valued. Additionally, the M.Sc Mathematics program contributes to the advancement of knowledge in mathematics and its applications, driving innovation and progress in diverse fields.

2. Procedure for Admission and Curriculum Transaction

The academic programs catered to candidates enrolled in the Distance mode of learning are facilitated by CDOE-JNU, with the backing of various faculties within the University. Eligibility criteria, course structure, detailed curriculum, program duration, and evaluation criteria are subject to approval by the Board of Studies and Academic Council, adhering to UGC guidelines for programs falling under the purview of Distance mode for degree conferment.

Below are the details of the admission procedure, eligibility criteria, fee structure, curriculum, program delivery, information about the Learning Management System (LMS), and assessments and evaluations.

2.1Procedure for Admission

Students who are seeking admission in programs offered by CDOE-JNUneed to apply through https://online.jnujaipur.ac.in/in the courses offered.

2.1.1 Minimum Eligibility Criteria for Admission

The minimum eligibility criteria for admission to the DistanceM.SC - MATHEMATICS program require candidates to hold a Bachelor's degree of a minimum duration of 3 years from a recognized University in any stream, in accordance with UGC and AICTE norms. Additionally, candidates must have secured at least 40% marks in the qualifying examination.

Candidates must also fulfill all documentation requirements as specified on the program's website for admission purposes. Failure to submit proof of eligibility within the stipulated timeframe specified by CDOE-JNU will result in the cancellation of admission. Prospective candidates are encouraged to carefully review all instructions provided on the website before proceeding with the application process.

2.1.2 Admission Process and Instructions: Learner Communication

The admission process for the students is provided below:

Step	Process	Particulars
Step 1	**Counselling**	Prospective students will receive guidance and counseling for their chosen program from designated and authorized counsellors.
Step 2	**Registration on admission portal to get access to My Account.**	They must then complete the application form by providing all necessary details and uploading mandatory documents.
Step 3	**Details of Document upload**	Student Uploads document as follows- <u>Personal Documents</u> Passport-size Photograph Student's Signature Aadhar Card (Back & Front) <u>Academic Documents</u> *UG Student* - 10th Marksheet 12th Marksheet *PG Student* - 10th Marksheet 12th Marksheet UG Marksheet Other Certificates (detailed list of documents is provided in **Annexure II**)
Step 4	**Verification of documents by the Deputy Registrar**	The Deputy Registrar is responsible for verifying all documents uploaded by prospective students on the admission portal. Within a timeframe of 48 hours, the Deputy Registrar will review and either approve or disapprove the eligibility of the prospective student for the chosen program.
Step 5	**Undertaking**	Student will sign Undertaking after Approval in Application.
Step 6	**Payment of fees**	All eligible students, duly approved by the Deputy Registrar, will get fees payment link activated in their My Account for payment. The Fee is payable through any of the following means: (a) UPI (b) Credit/Debit Card

		(c) Net-banking Note: Cash, bank demand draft and Cheques are not accepted
Step 7	**Enrolment**	After the payment of program fee, the eligible student will get the Enrolment number and access to the LMS within 21 days.
Step 8	**Access to Learning Management System (LMS)**	

General Instructions:

1. Prior to applying for Distance programs, all students are advised to thoroughly read and comprehend the eligibility conditions provided in the student handbook document and outlined on the university website.
2. It is the responsibility of prospective learners to ensure that their educational or qualifying degree has been issued by a recognized university or board only. For learners from Indian higher education institutions, recognition by the regulatory authority of the Government of India is necessary. To verify degrees from recognized boards of education, refer to www.cobse.org.in/. For Polytechnic Diploma, check the respective State Board of Technical Education. Verification of degrees from recognized universities can be done at www.ugc.ac.in/. Foreign prospective learners should verify their institutions at www.aiu.ac.in/.
3. Prospective learners must verify their eligibility on the date of admission and ensure that they have passed the qualifying exams before the commencement of the admission batch.

Upon enrollment, students must register with the Academic Bank of Credits (ABC), a central scheme for depositing credit formulated by the Ministry of Education, Government of India. Creation of an Academic Bank of Credits (ABC) ID is mandatory for all students. (Refer to Annexure V for details).

2.1.3 Program Fee for the Academic Session beginning July 2024

Program fees for students pursuing M.SC - Mathematics offered by CDOE-JNU is mentioned below:

Program	Academic Total Fees (INR)	Exam Fees
M.SC - Mathematics	**40,000**	**1500 per semester**

2.2 Curriculum Transactions

2.2.1 Program Delivery

The curriculum is delivered through Self Learning Materials (SLMs) in the form of e-Contents, supplemented by a variety of learning resources including audio-video aids via the Learning Management System (LMS). Furthermore, the program includes contact hours featuring synchronous live interactive sessions conducted through the LMS, adhering to the current UGC norms for course delivery.

2.2.2 Learning Management System to support Distance mode of Course delivery

The Learning Management System (LMS) is available on URL https://lms.jnujaipur.ac.in/users/login is meticulously developed to offer students a truly global learning experience. With a user-friendly interface, the LMS simplifies the learning process and ensures it meets the highest global standards. Utilizing audio-visual teaching methods, self-learning materials, and evaluation patterns, the platform stands out as unique and aligns seamlessly with both industry requirements and the UGC Guidelines.

Students can engage in uninterrupted learning 24x7 via web and mobile devices, allowing them to progress at their preferred pace. The LMS boasts a simple and intuitive user interface, facilitating easy navigation through the e-learning modules. Designed in accordance with standard norms, all learning tools are easily accessible, ensuring a perfect learning experience for all users.

2.2.3 Course Design

The curriculum is designed by a committee comprising experts from the parent department of the University and Industry experts, keeping in view the needs of the diverse groups of learners.

2.2.4 Academic Calendar for Academic Session beginning July 2024

Sr. No.	**Event**	**Session**	**Month (Tentative)**
1.	Commencement of semester	January	January
		July	July

2.	Enrol learner to Learning	January	Within 21 working days from fee deposit and Eligibility confirmation
	Management system	July	
3.	Interactive Live Lectures for query resolution	January	February to May
		July	August to November
4.	Assignment Submission	January	By April
		July	By October
5	Project Report Submission	January	Last week of April
	(Wherever applicable during Final semester)	July	Last week of November
6	Term End Examination	January	May onwards
		July	December onwards
7	Result Declaration of End Term Examination	January	By June
		July	By January

3. Instructional Design

3.1 Curriculum Design

The curriculum is meticulously designed by experts in the field of Mathematics, incorporating contemporary topics and fostering environmental awareness. It has received approval from the Board of Studies, the Centre for Internal Quality Assurance (CIQA), and the University Academic Council.

3.2 Program Structure and detailed Syllabus

3.2.1 Program Structure

Semester: I

Course code	Subject Name	Course Category	Hours Per Week			Credits	Evaluation Scheme		Total
			L	T	P		Int	Ext	
DMSMCO101T24	Calculus of variation and special functions	Core	4	0	0	4	30	70	100
DMSMCO102T24	Differential Equations	Core	4	0	0	4	30	70	100
DMSMCO103T24	Real Analysis	Core	4	0	0	4	30	70	100
DMSMCO104T24	C Programming	Core	4	0	0	4	30	70	100
DMSMCO104P24	C Programming Lab	Core	0	0	4	2	30	70	100
DMSMDS101T24	**Industrial Mathematics	DSE	4	0	0	4	30	70	100
DMSMDS102T24	*Hydrodynamics								
DMSMVA101T24	Waste water Treatment	VAC	2	0	0	2	30	70	100
	Select One from list	*GE/OE	2	0	0	2	30	70	100
	Total		**24**	**0**	**4**	**26**			

L: Lecturer, **T**: Tutorial, **P**: Practical **IA:** Internal Assessment, **ETE:** End Term Exam

*Students can obtain credits from MOOC. ** Students can obtain credits from University or from MOOC.

Sr. No	Subject Code	Name of Subject	Name of School
1	DMSMGE101T24	Productivity Tools	SCHOOL OF COMPUTER AND SYSTEM SCIENCES
2	DMSMGE102T24	Understanding Prescription, Doses and doses forms	SCHOOL OF PHARMACEUTICAL SCIENCES
3	DMSMGE103T24	Dining etiquettes	SCHOOL OF HOTEL MANAGEMENT AND CATERING TECHNOLOGY
4	DMSMGE104T24	Basics of Photography	SCHOOL OF MEDIA STUDIES
5	DMSMGE105T24	Mobile App Designing	SCHOOL OF ENGGINEERING AND TECHNOLOGY

Semester: II

Course code	Subject Name	Course Category	Hours Per Week			Credits	Evaluation Scheme		Total
			L	T	P		Int	Ext	
DMSMCO201T24	Numerical and Statistical Techniques	Core	4	0	0	4	30	70	100
DMSMCO202T24	Abstract Algebra	Core	4	0	0	4	30	70	100
DMSMCO203T24	Mathematical Programming	Core	4	0	0	4	30	70	100
DMSMCO204T24	Continuum mechanics	Core	4	0	0	4	30	70	100
DMSMCO201P24	Numerical & Statistical Techniques Lab	Core	0	0	4	2	30	70	100
DMSMDS201T24	Computer Application	DSE	4	0	0	4	30	70	100
DMSMDS202T24	Differential Geometry								
DMSMVA201T24	Biostatistics	VAC	2	0	0	2	30	70	100
	OE		2	0	0	2	30	70	100
	Total		**24**	**0**	**4**	**26**			

L: Lecturer, **T**: Tutorial, **P**: Practical **IA:** Internal Assessment, **ETE:** End Term Exam
Exit Option:-PG Diploma in Mathematics.
Min Credit 52.

Students can choose any one subject from the following list of subjects:

Sr. No	Subject Code	Name of Subject	Name of School
1	DMSMGE201T24	Website Designing	SCHOOL OF COMPUTER AND SYSTEM SCIENCE
2	DMSMGE202T24	Introduction to Epidemiology	SCHOOL OF PHARMACEUTICAL SCIENCES
3	DMSMGE203T24	Basics of Baking	SCHOOL OF HOTEL MANAGEMENT AND CATERING TECHNOLOGY
4	DMSMGE204T24	Videography	SCHOOL OF MEDIA STUDIES
5	DMSMGE205T24	Food Processing & Preservation	SCHOOL OF ENGGINEERING AND TECHNOLOGY

Semester: III

Course code	Subject Name	Course Category	Hours Per Week			Credits	Evaluation Scheme		Total
			L	T	P		Int	Ext	
DMSMCO301T24	Linear Algebra	Core	4	0	0	4	30	70	100
DMSMCO302T24	Mechanics	Core	4	0	0	4	30	70	100
DMSMCO303T24	Integral Transforms	Core	4	0	0	4	30	70	100
DMSMCO304T24	Advance differential equations	Core	4	0	0	4	30	70	100
DMSMCO305P24	Optimization Techniques Simulation Lab	Core	0	0	4	2	30	70	100
DMSMDS301T24	Viscous Fluid Dynamics	DSE	4	0	0	4	30	70	100
DMSMDS302T24	Combinatorics & Graph Theory								
DMSMVA301T24	Research Methodology	VAC	2	0	0	2	30	70	100
	OE		2	0	0	2	30	70	100
	Total		**24**	**0**	**4**	**26**			

L: Lecturer, **T**: Tutorial, **P**: Practical **IA:** Internal Assessment, **ETE:** End Term Exam

*Students can choose any one subject from the following list of subjects:

Sr. No	Subject Code	Name of Subject	Name of School
1	DMSMGE301T24	Basics Computer Networks - Everyone Must Know	SCHOOL OF COMPUTER AND SYSTEM SCIENCES
2	DMSMGE302T24	Public Health Pharmacy	SCHOOL OF PHARMACEUTICAL SCIENCES
3	DMSMGE303T24	Rajasthani and Punjabi cuisine	SCHOOL OF HOTEL MANAGEMENT AND CATERING TECHNOLOGY
4	DMSMGE304T24	Script writing for film	SCHOOL OF MEDIA STUDIES
5	DMSMGE305T24	Solar & Renewable Energy	SCHOOL OF ENGGINEERING AND TECHNOLOGY

Semester: IV

Course code	Subject Name	Course Category	Hours Per Week			Credits	Evaluation Scheme		Total
			L	T	P		Int	Ext	
DMSMCO401T24	Functional Analysis	Core	4	0	0	4	30	70	100
DMSMCO402T24	Integral Equations	Core	4	0	0	4	30	70	100
DMSMCO403T24	Complex Analysis	Core	4	0	0	4	30	70	100
DMSMCO404T24	Number Theory	Core	4	0	0	4	30	70	100
DMSMCO405P24	Dissertation	Core	0	0	12	6	30	70	100
DMSMDS401T24	Difference Equations and Sampling Theory	DSE	4	0	0	4	30	70	100
DMSMDS402T24	Mathematical Statistics								
DMSMVA401T24	Scientific Writing & Academic Integrating	VAC	2	0	0	2	30	70	100
	OE		0	0	2	2	30	70	100
	Total		**22**	**0**	14	30			

L: Lecturer, **T**: Tutorial, **P**: Practical **IA:** Internal Assessment, **ETE:** End Term Exam

Course Completion:-

Master of Science in Mathematics with minimum 108 Credits.

*Students can choose any one subject from the following list of subjects:

Sr. No	Subject Code	Name of Subject	Name Of School
1	DMSMGE401T24	End User Database Management System	SCHOOL OF COMPUTER AND SYSTEM SCIENCES
2	DMSMGE402T24	Social Pharmacy	SCHOOL OF PHARMACEUTICAL SCIENCES
3	DMSMGE403T24	Reception management	SCHOOL OF HOTEL MANAGEMENT AND CATERING TECHNOLOGY
4	DMSMGE404T24	Radio Jockey	SCHOOL OF MEDIA STUDIES
5	DMSMGE405T24	Industrial Safety & Hazard Management.	SCHOOL OF ENGGINEERING AND TECHNOLOGY (SADTM)

3.2.2 Detailed Syllabus of M.SC - MATHEMATICS

Detailed syllabus of M.SC - MATHEMATICS is attached in Annexure-I.

3.3 Duration of the Program

Program	Level	Duration	Maximum duration for completion	Credits
M.SC – MATHEMATICS	Master's Degree	2 years (4 Semesters)	4 Years	108

3.4 Faculty and Support staff requirements (Refer Regulation Document for all Staff Details)

Academic Staff	Number available to meet the norms
Program Coordinator	1 Member
Course Coordinator	44
Course Mentor	1 Member per batch of 250 students

3.5 Instructional delivery mechanisms

JNU boasts a fully dedicated team of faculty members and staff proficient in delivering lectures through CDOE – JNU. At the commencement of each session, students will receive the academic calendar via the Learning Management System (LMS). The distribution of self-learning material, audio, and video content to students will be facilitated through the LMS via the following delivery channels:

- Self-Learning Material (Hard Copy will be provided to student)
- EBooks
- Study Guide
- Question Bank in Learning Management system - For Practice Test through LMS
- Audio / Video Component in Learning Management System
- Assignments (Submitted through Assignment Response Sheet)
- Personal Contact Program would be conducted at University Campus.
- Live Interactive Sessions would be conducted through the learning management system

3.6 Identification of media-print, audio, or video, online, computer aided

The Learning Management System (LMS) serves as a comprehensive digital platform, offering a multitude of features including recorded faculty video lectures, live sessions, e-content comprising study material, open source materials, and graded assessments.

For each module within a course, there will be one live session conducted by the respective faculty member, focusing on a specific topic. CDOE-JNU has curated study material that is clear and easily comprehensible, complete with concise summaries, self-assessment questions, and case studies.

Access to these course materials is facilitated through:

- Login credentials provided in the welcome email sent by the university
- Students can also log in via the University website at https://lms.jnujaipur.ac.in/

Courseware

Through the Learning Management System (LMS), students will have access to a comprehensive array of course materials mentioned above.

The Dashboard feature of the LMS serves to track and monitor students' learning progress. It includes functionalities such as:

- Monitoring progress in learning
- Comparing progress with peers
- Receiving regular notifications about upcoming Live Sessions, assignments, and examinations

3.7 Student Support Services

Students will have access to support services provided by CDOE-JNU through the Student Relationship Management (SRM) system for queries related to administration and general technical issues. A ticketing system integrated into the LMS will enable learners to connect with the CDOE-JNU technical team for support services, with resolutions handled by the appropriate authority. Notifications will also be sent to the Deputy Registrar to ensure queries are addressed within 24 hours or sooner.

For academic course-related queries, students can raise queries directly with the Course Coordinator, Program Coordinator, and Deputy Director. Queries should be resolved within 48 hours of being raised, with the Program Coordinator responsible for managing and

resolving any unresolved matters. The Deputy Director will ensure the timely resolution of academic queries.

In addition to academic excellence, CDOE-JNU prioritizes the holistic development of its students. The department supports various initiatives to broaden students' opportunities and shape them into future leaders.

4. Assessment and Evaluation

4.1 Overview

The evaluation of students' learning will encompass internal assignments, quizzes, learner response sheets, and end-of-term examinations. CDOE-JNU follows a rigorous process in the development of question papers, creation of question and quiz banks, preparation and moderation of assignments, administration of examinations, analysis of answer scripts by qualified academics, and declaration of results. Question papers are meticulously framed to ensure comprehensive coverage of the syllabus.

The evaluation process will include two types of assessments:

Examination Name	Marks Division
Continuous internal assessment	30%
Summative assessment in the form of end-term examination. End-term examination will be held with proctored examination tool technology (follow **Annexure VI** for guidelines and pre-requisites for Proctored Examination)	70%

The examinations are designed to evaluate the knowledge acquired during the study period.

For theory courses, internal evaluation will be conducted through Continuous Internal Assessment (CIA), which includes assignments and quizzes. The internal assessment will contribute a maximum of 30 marks for each course.

At the end of each semester, an end-of-semester examination will be held for each course, lasting two hours.

Guidelines issued by the Regulatory Bodies from time-to-time about conduct of examinations shall be considered and new guidelines if any will be implemented.

4.2 Question Paper Pattern

Exam Time: 2 Hours

Max. Marks: 70

Exam will be comprising of 70 Multiple-Choice Questions (1 Mark Each) – 70 Marks

4.3 Distribution of Marks in Continuous Internal Assessments

The following procedure shall be followed for internal marks for theory courses. Weightage for Assignment is provided below:

Particular	A1 (MCQ Type)	A2 (MCQ Type)
Marks	15	15

Note: Refer to **Annexure VI** and **VII** for reference to the question paper pattern and formats of documents accepted.

Students may re-appear for CIA up to next two semesters and has to follow the same procedure. For the last semester the academic rules shall apply.

4.4 Statistical Method for the Award of Relative Grades

Letter Grade	Grade point	Range of Marks(%)
O (Outstanding)	10	90-100
A+ (Excellent)	9	80-89
A (Very good)	8	70-79
B+ (Good)	7	60-69
B (Above average)	6	50-59
C (Average)	5	40-49
P (Pass)	4	35-39
F (Fail)	0	0-34
Ab (Absent)	0	Absent

Abbreviations:

CO	Core Course	MM	Maximum Marks
DSC	Discipline Specific Course	MO	Marks Obtained
GE	Generic Elective Course	SE	Skill Enhancement
AE	Ability Enhancement	DSE	Discipline Specific Elective

4.4.1 Cumulative Grade Point Average (CGPA) and Semester Grade Point Average

Semester Grade Point Average (SGPA):

It is the summation of product of Credit Points and Grade Points divided by the summation of Credits of all Courses taught in a semester.

SGPA = $\Sigma C_i G_i / \Sigma C$

Where, G is grade and C. is credit for a Course.

Cumulative Grade Point Average (CGPA): $CGPA = \Sigma(C_i \times Si)/\sum c.$

Where, Si is the SGPA of the semester and Ci is the total number of credits in that semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Note:

- In case of any mistake being detected in the preparation of the Grade Statement at any stage or when it is brought to the notice of the concerned authority the University shall have the right to make necessary corrections.

4.4.2 Cumulative Grade Point Average (CGPA)

CGPA will be used to describe the overall performance of a student in all courses in which letter grades are awarded since his entry into the University or transferred from other University upto the latest semester as per the procedure provided in JNU Academic Regulations. It is the weighted average of the grade points of all the letter grades received by the student from his entry into the University or transferred from other University. Since multiple performance in a course in which the student has already received a grade is possible, whenever through such a process a new grade is obtained, it will replace the earlier one in the calculation of CGPA. On the other hand, if through this process merely a report emerges, this event by itself will not alter the CGPA.

A student's grades, reports, CGPA, etc. at the end of every semester/term will be recorded on a grade card, a copy of which will be issued to him. The grade card will be withheld if a student has not paid his dues or when there is a pending case of breach of discipline or a case of unfair means against him.

The faculty members also responsible for maintaining the complete records of each student's attendance, performance in different components of evaluation. If a scrutiny or statistical analysis becomes necessary, the above records and any other pertinent information should be made available by the faculty member of the course.

4.4.3 Conversion Factor

Formula for Conversion of CGPA to Percentage:

Percentage of marks = CGPA ^{x} 10

4.5 Grade card

All grades and reports and other pertinent information for a semester are given in a grade card which is a complete record of the outcome of what was intended in the original registration. The various grades and reports would be appropriately used to tally the grade card with the original registration.

Chronologically organized information from the grade cards of a student with the necessary explanation constitutes is transcript which is issued at the time the student leaves the University or at an intermediate point on request.

4.5.1 Grade cards and Certification – Student Communication

- The student can get soft copy of grade cards through the University website, the hard copy grade card would be provided only after successfully completion of full program along with degree certificate.
- Once the student completes all the mandated assignments, examinations and projects (if applicable) the final mark sheet/grade card and certificate would be dispatched by the University to the student registered address.
- All pending payments/dues need to be cleared by the student, before the final certification.

- If required, the University may request the mandatory documents from student as submitted during admission time, the students may have to re-submit the same if required during final degree certification.

Students need to apply for degree by filling the degree application form and submit all the required documents and the applicable degree processing application fees as mentioned in this document.

4.5.2Results, grade card and Degree Logistics–Internal Process

- After verification of all data by the Controller of Examination, the results would be published on the CDOE-JNU website.
- Students need to download and save the copy of semester / year wise results.

CDOE-JNU would provide hard copy grade cards and degree certificate at the end of the program to students who have successfully completed the program. Students who successfully completed the program will receive hard copy mark sheet/grade cards and a degree certificate from the University at the end of the program. A provision for On Demand Mark Sheets can be provided wherein student would have to fill the requisition and pay postal charges enabling university to dispatch the hard copy marksheets as requested by the student; prior to completion of the overall program.

5. Requirement of the Laboratory Support and Library Resources

5.1 Laboratory Support

Jaipur National University offers access to state-of-the-art laboratories equipped with the latest tools and resources necessary for research and analytical work. The laboratory support at JNU aims to foster a robust research environment, encouraging students to develop essential skills required for their academic and professional growth.

5.*2 Library Resources*

The Central Library at CDOE-JNU offers a comprehensive range of sections, including reference, circulation, audio-visual, periodical, book-bank, digital library, and reprographic sections. With a collection exceeding 1,00,000 books, the library also provides access to e-journals, online databases such as Scopus and Web of Science, and institutional repositories featuring rare book collections. University has 449 subscriptions of online and offline

Journals. Equipped with modern facilities like reading rooms, computer labs, and quiet study areas, the library fosters a conducive environment for learning and intellectual growth. Additionally, the library frequently organizes workshops, seminars, and exhibitions to enhance academic engagement and promote a culture of continuous learning.

All electronic resources can be accessed seamlessly through the Local Area Network (LAN) on campus, as well as remotely via login credentials. This ensures convenient access to resources for students, faculty, and researchers both on-site and off-site.

6. Cost Estimate of the Program and the Provisions

The Estimate of Cost & Budget could be as follows (all figures on Annual basis) :

Sl. No.	Expenditure Heads	Approx. Amount
1	Program Development (Single Time Investment)	30,00,000 INR
2	Program Delivery (Per Year)	2,00,000 INR
3	Program Maintenance (Per Year)	5,00,000 INR

7. Quality Assurance Mechanism

The quality of a program hinges upon the course curriculum, syllabus, and academic delivery, all of which are meticulously designed to bridge the gap between industry standards and academia. To uphold this standard, the Centre for Internal Quality Assurance (CIQA) and the Academic Council play crucial roles.

The Academic Council is entrusted with ratifying the curriculum and any proposed changes recommended by CIQA to ensure the continual enhancement and maintenance of quality in education at CDOE-JNU.

The Centre for Internal Quality Assurance (CIQA) is tasked with several responsibilities:

(i) Conducting periodic assessments of learning course materials and audio-video tutorials to maintain the quality of learning.

(ii) Soliciting stakeholder feedback and implementing recommended changes to meet the evolving needs of course delivery and industry requirements.

(iii) Evaluating the quality of assignments, quizzes, and end-term assessments and providing suggestions for enhancements to sustain the learning program's standards.

(iv) Ensuring that the learning experience is truly global, aligning with program outcomes and reflecting the vision and mission of JNU.

The Chief Operating Officer (CoE) of the University oversees examinations and the evaluation system to ensure fairness and integrity in the assessment process.

CDOE-JNU is committed to continual improvement, striving to enhance processes, assessments, teaching methodologies, and e-learning materials in line with implementation of the New Education Policy (NEP). The University is dedicated to delivering exceptional education across all learning modes while adhering to NEP, UGC, and other regulatory guidelines, fostering a truly global educational environment.

****

Annexure I _Detailed syllabus of M.SC – MATHEMATICS Program

Semester I

Course Code: DMSMCO101T24	Core Course 1 M.Sc. Mathematics **Calculus of Variation and Special Functions**	**C - 4**
Course Outcomes	**On completion of the course, the students will be able to**	
CO1	Remember the variational problems. Derive the Euler-Lagrange equations for variational problems, including the case of general variations.	
CO2	Explain the conserved quantities from symmetries, and use them to solve the Euler-Lagrange equations.	
CO3	Apply variational problems with constraints: both algebraic and isoperimetric.	
CO4	Analyze the various applications of the fundamental theorem of Gauss Hypergeometric Function.	
CO5	Evaluate Bessel, differential equations along with the corresponding recurrence formulas of different functions.	
CO6	Create Legendre differential equations along with the corresponding recurrence formulas of different functions.	
Course Content		
Block 1	Calculus of variation – Functionals, Variation of a functional and its properties, Variational problems with fixed boundaries, Euler's equation, Extremals, Functional dependent on several unknown functions and their first order derivatives.	
Block 2	Functionals dependent on higher order derivatives, Functionals dependent on the function of more than one independent variable, Variational problems in parametric form, Direct methods for variational problems, Rayleigh-Ritz method.	
Block 3	Gauss hypergeometric function and its properties, Series solution of Gauss hypergeometric equation. Integral representation, Linear and quadratic transformation formulas, Contiguous function relations, Differentiation formulae, Linear relation between the solutions of Gauss hypergeometric equation, Kummer's confluent hypergeometric function and its properties, Integral representation.	
Block 4	Bessel function Jn(x) , Legendre polynomials and functions Pn(x) and Qn(x).	
Text Books	1.Calculus of Variation with Applications, A. S. Gupta, Prentice-Hall, India, 2000. 2.Calculus of Variations with Applications, G. M. Ewing, Dover, 2000. 3.Introduction to Calculus of Variations, H. Sagan, Dover, 2010. 4.Variational Calculus and Optimal Control, J. L. Troutman, 2nd edition, Springer Verlag, 2015. 5.Special functions and calculus of variations, PK Banerji, VBL Chaurasia, MA Pathan, Indus valley publications,2010. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals	
Learner Support Material	NPTL, Swayam (https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO102T24	Core Course 2 M.Sc. Mathematics **Differential Equations**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Understand the derivation of differential equation, Linear partial differential.	
CO2	Explain Methods of Solving of Differential equations of first order	
CO3	Apply Lagrange's linear equation, Lagrange's solution of the linear equation.	
CO4	Analyze Geometrical interpretation of Lagrange's linear equation.	
CO5	Evaluate the linear equations with n independent variables, special types of equations.	
CO6	Create the Nonlinear PDE of first order, solve using Charpit's method.	
Course Content		
Block 1	**Differential Equations**: Ordinary Differential Equations of Second Order With Variable Coefficients-Homogeneous Form, Exact Form, Solution When a Part of C.F. is Known, Change of Dependent Variable, Change of Independent Variable, Variation of Parameters, and Solution In Series.	
Block 2	**Partial differential equations of first order**: Lagrange's method and standard forms, Charpit's method, Method of Separation of variables-Application to the solution of wave equation in one dimension, Laplace's equation in two dimensions, Diffusion equation in one dimension, Partial differential equations of second order with variable co-efficients- Monge's method.	
Block 3	**Total Differential equations**: Forms and solutions, necessary and sufficient condition, Geometrical Meaning Equation containing three and four variables, total differential equations of second degree.	
Block 4	**Series Solution**: Radius of convergence, method of differentiation, Cauchy-Euler equation, Solution near a regular singular point (Method of Forbenius) for different cases, Particular integral and the point at infinity. Nonlinear Differential equations.	
Text Books	1. "Mathematical Methods"- Potter, M C; Goldberg Jack, Prentice Hall of India Learning Pvt. Ltd, 2016. 2. Ordinary Differential Equations, Simmons, McGraw-Hill; 2nd edition, 2010. 3. Ordinary Differential Equations, Lakshmikantham, Deo and Raghavendra, McGraw- Hill, 2000. 4. Introductions to Partial Differential Equations, K, Sankara, Rao, Prentice Hall of India Learning Pvt. Ltd, 2010. 5. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals	
Learner Support Material	NPTL, Swayam (https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO103T24	Core Course 3 M.Sc. Mathematics **Real Analysis**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Understand the derivation of differential equation, Linear partial differential.	
CO2	Explain Methods of Solving of Differential equations of first order	
CO3	Apply Lagrange's linear equation, Lagrange's solution of the linear equation.	
CO4	Analyze Geometrical interpretation of Lagrange's linear equation.	
CO5	Evaluate the linear equations with n independent variables, special types of equations.	
CO6	Create the Nonlinear PDE of first order, solve using Charpit's method.	
Course Content		
Block 1	Review of basic concepts of real numbers: countable and uncountable sets, Real number system, Archimedean property, supremum, infimum and Completeness. Continuity and uniform continuity. Metric spaces and its topology. Weierstras's theorem, Continuity of functions in metric spaces. Compactness and Connectedness. Discontinuities. Monotonic functions	
Block 2	Sequences and series, Convergent sequences. Cauchy sequences. Upper and Lower limits. Cauchy's general Principle of convergence. Series of nonnegative terms and convergence tests. Absolute and conditional convergence. Explain bounded, convergent, divergent, Cauchy and monotonic sequences.	
Block 3	Sequences and series of functions. Pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weirstras's M-test, Abel's test and Dirichlet's test for uniform convergence, uniform convergence and continuity, uniform convergence and differentiation, existence of a Power series.	
Block 4	Functions of several variables : linear transformations, derivative in an open subset of Rn, Chain rule, partial derivatives, directional derivatives, the contraction principle, inverse function theorem, Implicit function theorem, Jacobians, extremum problems with constraints, Lagrange's multiplier method.	
Text Books	1. Principles of Mathematical Analysis by W.Rudin, 2010. 2. Mathematical Analysis by T.M.Apostol, Narosa Publishing House, 2000. 3. Theory of Functions of a Real Variable, Volume 1 by I. P. Natanson, Frederick Pub. Co.2015. 4. Real Analysis by H.L. Royden, McMillan Publication Co. Inc. New York, 2016. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO104T24	Core Course 4 M.Sc. Mathematics **C Programming**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the basics of C programming.	
CO2	Explain the sequence of the program and give logical output.	
CO3	Apply the uses of pre-processors and various memory models.	
CO4	Analyze I/O operations in your C program. Repeat the sequence of instructions and points for a memory location.	
CO5	Evaluate strings in your C program& Store different data types in the same memory.	
CO6	Create code reusability with functions and pointers. Understand the basics of file handling mechanisms.	
Course Content		
Block 1	Introduction to 'C' programming: Fundamentals, Structure of a C program, Compilation and linking processes	
Block 2	Expressions and Console I/O: Basic Data types, Identifier Names, Variables, Scope, Type qualifiers, Storage class specifier, Constants, Operators, Reading and writing characters, Reading and writing strings.	
Block 3	Statements: True and False, Selection statements, Iteration statements, Jump statements, Expression statements, Block statements.	
Block 4	Structure and Union: definition and differences, self-referential structure. File Handling in C: opening and closing a text file, creating a text file, read and write functions.	
Text Books	1. "Let us C", Yashavant Kanetkar, BPB, 2015. 2. "Programming in C", Gottfried, Schaum's Series, Tata McGraw-Hill, 2013. 3. "Programming in ANSI C", E. Balagurusamy, TMH, 2000. 4. "The C Programming Language", Kernighan, Ritchie, Prentice Hall of India, 2010. * Latest Edition of all the suggested books are recommended	
Online Resources	Elsevier Computer Science Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMDS101T24	Discipline Specific Elective (DSE) - 1 M.Sc. Mathematics **Industrial Mathematics**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the linear programming problems by different methods and illustrate the concept of convex set & extreme points.	
CO2	Explain the relationships between the primal and dual problems, and to understand sensitivity analysis.	
CO3	Apply duality and dual simplex method.	
CO4	Analyze transportation model and finding solution of transportation problem.	
CO5	Evaluate assignment problem and method for solving it.	
CO6	Create linear programming models of real-life situations and apply these models to transportation, assignment in real world.	
Course Content		
Block 1	Finite difference schemes for partial differential equations – explicit and implicit schemes .Finite difference schemes for initial and boundary value problems – FTCS, backward Euler and Crank-Nicolson schemes, ADI methods. Application to problems of industry with special reference to Fluid Mechanics.	
Block 2	Operational Techniques for Linear Programming Problems, Computational procedure of Simplex method, Two-phase Simplex method, Big-M-method, Duality in linear programming, Duality and Simplex method.	
Block 3	Assignment models. Mathematical formulation, Hungarian method. Travelling Salesman problem. Transportation models. Mathematical formulation. Initial basic feasible solution. Degeneracy and unbalanced transportation problems. Advance Game Theory and its applications. Game problems using graphical method.	
Block 4	Queuing models: Basic components of a queuing system, General birth-death equations, steady state solution of Markovian queuing models with single and multiple servers (M/M/1, M/M/C M/M/1/k, M/MC/k).	
Text Books	1.Numerical Solutions to Partial Differential Equations, G. D. Smith, Oxford University Press, 3rd Edn., 2000. 2. "Mathematical Methods"; Potter, M C; Goldberg Jack, Prentice Hall of India, 2015. 3. Operations Research; S. D. Sharma, Kedar Nath Ram Nath and co, 2016. 4. Operations research; Kanti Swarup, P.K. Gupta and Manmohan, S. Chand & Co, 2017. 5. Operations Research; Hamady Taha, MacMillan Co, 2017. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMDS102T24	Discipline Specific Elective (DSE) - 2 M.Sc. Mathematics **Hydrodynamics**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the Lagrangian and Eulerian methods. Stream lines, Stream tubes, equation of continuity, irrotational.	
CO2	Explain the use of complex potential for irrotational flow.	
CO3	Apply Euler's dynamical equations and surface conditions.	
CO4	Analyze the Axi-Symmetric fluid motion, Stokes' stream function.	
CO5	Evaluate Kinetic energy of an infinite mass of fluid.	
CO6	Create relation between stress and rate of strain components.	
Course Content		
Block 1	Lagrangian and Eulerian methods. Stream lines, Stream tubes, equation of continuity, irrotational and rotational motion, circulation. Euler's dynamical equations, surface conditions. Velocity potential, Bernoulli's theorem.	
Block 2	Motion in two dimensions, stream function. Use of complex potential for irrotational flow. Circle theorem, uniqueness theorem, Kinetic energy of an infinite mass of fluid, constancy of circulation, and flow past a moving cylinder.	
Block 3	Axi-Symmetric fluid motion, Stokes' stream function, flow past a solid of revolution.	
Block 4	Visocosity, Most general motion of a fluid element, stain quadric, stress quadric. Relation between stress and rate of strain components.	
Text Books	1. Milne-Thomson: Theoretical Hydrodynamics, 2015. 2. G. K. Batchelor: An Introduction to Fluid Dynamics, 2000. 3. N. Curle and H. J. Davies: Modern Fluid Dynamics,Vol. I.,2015. 4 .R. C. Binder: Advanced Fluid Mechanics, 2017. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMVA101T24	Value Added Course (VAC) - 1 M.Sc. Mathematics **Waste Water Treatment**	**C - 2**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the knowledge of local, national and international laws, regulations and guidelines that underpin the choice of various water and sewerage treatment processes.	
CO2	Explain the basic important principles, concepts and theories for the design of water and wastewater treatment processes.	
CO3	Apply key theories and principles for the design and selection of appropriate technology in water and wastewater treatment.	
CO4	Analyze water quality parameters COD, BOD, TDS, pH etc.	
CO5	Evaluate Water Pollution.	
CO6	Create the treatment of potable and sewage wastewater.	
Course Content		
Block 1	Characteristics and sources of water, Water Pollution: International Standards of drinking water, water quality parameters COD, BOD, TDS, pH etc.	
Block 2	Treatment of potable and sewage waste water.	
Text Books	1. Water Chemistry: An Introduction to the Chemistry of Natural and Engineered Systems, Brezonik, P.L.; Arnold, W.A., Oxford University Press. 2011. 2. Water Quality and Treatment, 5th edition, R. Letterman, Editor, American Water Works Association, Denver, CO, 2015. 3. Metcalf and Eddy, Wastewater Engineering, 4th ed., McGraw Hill Higher Edu., 2016. 4. Textbook of Water Supply & Sanitary Engineering: S.K. Husain. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO104P24	Core Course Lab - 1 M.Sc. Mathematics **C Programming Lab**	**C - 2**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Write the C code for a given algorithm.	
CO2	Explain the basic Structure of the C-PROGRAMMING, declaration and usage of variables.	
CO3	Apply the odd series, even series, power series, Fibonacci series, sine series and cosine series.	
CO4	Analyze the C programs using operators, conditional and iterative statements to Write C programs.	
CO5	Assess the programs that perform operations using derived data types.	
CO6	Build a Program with pointers and arrays, perform pointer arithmetic, and use the pre-processor.	
Exercises		
Experiment 1	WAF to display "Hello".	
Experiment 2	WAP and define an algorithm that returns the number of years until a father will have an age double of its son's age.	
Experiment 3	WAP to convert temperature in Fahrenheit or Celsius $Celsius = (F + 32) * \frac{5}{9}$ [Hint: using switch case]	
Experiment 4	WAP to calculate Simple Interest on the basis of Principal, rate of interest and number of years given as input by the user using switch statement. HINT : $SI = (P * R * T) / 100$ and $CI = p * [(1 + (R/100))\text{^}\ N]$.	
Experiment 5	WAP and find the flowchart and algorithm of a program that finds the minimum of three values a, b and c.	
Experiment 6	WAP with the flowchart and associated algorithm that compare two numbers a and b.	
Experiment 7	WAP and work out the algorithm that output the solutions of a 2^{nd} order polynomial ax2+bx+c=0, given the parameters a, b and c. Only real solutions will be treated. The cases with 1 or 2 solutions will be separated.	
Experiment 8	WAP and define the flowchart of a program where the user supplies integer values between 1 and 9 and the program returns the sum, average and RMS of the values. The program will exit when 0 is entered. Values outside of the bounds will be discarded.	
Experiment 9	WAP to print the following * 1 * * 2 2 * * * 3 3 3 * * * * 4 4 4 4	
Experiment 10	WAP to generate odd series 1+3+5+7+9+……..	

Experiment 11	WAP to generate even series 2+4+6+8+10+……..
Experiment 12	WAP to generate power series as 1+4+9+16+25+……
Experiment 13	WAP to find the factorial of a given number where if the number is lesser than 2 then factorial =1.
Experiment 14	WAP to generate Fibonacci series as 0,1,1,2,3,5,8,13,…….. [Hint Sum ofd 2 previous terms becomes new terms]
Experiment 15	WAP to generate sine series. As x-x3/3!+x5/5!-x7/7!+…..
Experiment 16	WAP to generate cosine series as 1-x2/2!+x4/4!-x6/6!+…
Experiment 17	WAP to find whether the given number is Armstrong number or not.[153= 13+53+33]
Experiment 18	WAP to find whether the given number is palindrome no. Or not as 121=121 , 131=131, etc.
Experiment 19	WAP to find the sum of all the digits of a given number.
Experiment 20	WAP to calculate the power of a given number.
Experiment 21	WAP to display the sum of the elements of a linear array.
Experiment 22	WAP to display the elements in reverse order of an array.
Experiment 23	WAP to display the sum of rows and columns of a matrix.
Experiment 24	WAP to find the sum of the diagonals of a matrix.
Experiment 25	WAP to display the sum & product of two matrixes.
Experiment 26	WAP to search an element using linear search.
Experiment 27	WAP to search an element using binary search.
Experiment 28	WAP to sort an array using selection sort.
Experiment 29	WAP to compare two inputted strings and store the larger of the two into a new string [Use strcpy and strcmp functions].
Experiment 30	WAP to swap two numbers using pointers.
Experiment 31	WAP to display the contents of an array using pointers.
Experiment 32	WAP to store and display the employee data using structures.
Experiment 33	WAP to store the student data (roll no, name and marks in 5 subjects) and print his/her result showing his/her percentage as well as grade.
Experiment 34	WAF to swap two numbers using call by reference.
Experiment 35	WAF to calculate factorial of a number.
Experiment 36	WAF to find GCD of two numbers.
Experiment 37	WA recursive function to display the factorial of a number given as an argument.
Experiment 38	WAF that returns the no. of times it had been called upon.[Use static storage class].

Experiment 39	WAP to copy the contents of one text file into another.
Experiment 40	WAP to create a program that stores the record of three employees. [Use Binary files].
Text Books	1"Let us C", YashavantKanetkar, BPB, 2018. 2. "Programming in C", Gottfried, Schaum's Series, Tata McGraw-Hill, 2019. 3. "Programming in ANSI C", E. Balagurusamy, TMH, 2000. 4. "The C Programming Language", Kernighan, Ritchie, Prentice Hall of India, 2010. * Latest Edition of all the suggested books are recommended
Online Resources	Elsevier Computer Science Journals.
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.

Semester II

Course Code: DMSMCO201T24	Core Course - 1 M.Sc. Mathematics **Numerical and Statistical Techniques**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the numerical methods to obtain approximate solutions of mathematical problems.	
CO2	Explain the concepts of finite differences, interpolation, extrapolation, and approximation.	
CO3	Apply the methods to find the accuracy of the numerical solutions.	
CO4	Classify initial and boundary value problems in differential equations using numerical methods.	
CO5	Evaluate numerical differentiation when routine methods are not applicable.	
CO6	Develop numerical problems in diverse situations in physics, engineering etc.	
Course Content		
Block 1	**Floating point Arithmetic**: Representation of floating point numbers, Operations, Normalization, Pitfalls of floating point representation, Errors in numerical computation **Iterative Methods:** Zeros of a single transcendental equation and zeros of polynomial using Bisection Method, Regula-Falsi method, Newton Raphson method, Secant method, Rate of convergence of iterative methods.	
Block 2	**Simultaneous Linear Equations**: Solutions of system of Linear equations, Gauss elimination direct method and pivoting, Ill conditioned system of equations, refinement of solution. Gauss Seidal iterative method, Gauss-Jordan method. **Interpolation and approximation**: Finite differences, difference tables polynomial interpolation**:** Newton's forward and backward formula. Central difference formulae: Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula. **Interpolation with unequal intervals**: Langrange's interpolation, Newton divided difference formula.	
Block 3	**Numerical Differentiation and Integration**: Introduction, numerical differentiation, numerical integration, trapezoidal rule, Simpson's rules, Boole's rule, Weddle's rule, Euler- Maclaurin's formula. **Solution of differential equations**: Euler's method, Modified Euler's method, Picard's method, Taylor's method, Runge-Kutta method, Predictor-corrector method, Shooting Method. Difference equations.	
Block 4	**Frequency Chart**: Different frequency chart like histogram, frequency curve, Pi-chart. **Curve fitting, Cubic Spline and Approximation**: Method of least squares, fitting of straight lines, polynomials. **Time series and forecasting**: Moving averages, smoothening of curves, forecasting models and methods. Statistical quality controls methods **Testing of Hypothesis**: Test of significance, chi-square test, t-test, F-Test.	

Text Books	1. "Numerical Analysis", Sastry S.S., Prentice Hall of India Learning Pvt. Ltd,2015. 2. "Numerical Methods", Balaguruswamy E, McGraw-Hill Publishing Company, New Delhi, 2000. 3. "Applied Numerical Analysis'' Gerald & Wheatley', Addison-Wesley, 2000. 4. "Numerical Methods for Scientific and Engineering Computation, Jain, Iyengar and Jain, New Age International, 2017. * Latest Edition of all the suggested books are recommended
Online Resources	IOP Science Journals, Elsevier Mathematics Journals
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.

Course Code: DMSMCO202T24	Core Course - 2 M.Sc. Mathematics **Abstract Algebra**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the various algebraic structures.	
CO2	Explain the mathematical objects called groups.	
CO3	Apply the basic concepts to develop theorems.	
CO4	Analyze the significance of the notions of cosets, normal subgroups, and factor groups.	
CO5	Evaluate the fundamental concepts in field theory.	
CO6	Develop the classification of finite fields.	
Course Content		
Block 1	Groups, subgroups, Cosets, Lagrange's theorem, cyclic group, normal subgroups, quotient groups, permutation group. Homomorphism, isomorphism theorems and Cayley's theorem	
Block 2	Conjugacy, Class equation, Simple groups. Sylow theorems with applications, Normal and subnormal series, composition series, Jordan holder theorem. Solvable groups, simplicity of An ($n > 5$).	
Block 3	Rings, homomorphisms, ideals, Quotient rings, prime ideals, maximal ideals, Field of quotients of an integral domain, Euclidean rings, unique factorization domains, principal ideal domain	
Block 4	Polynomial rings, Eisenstenin's criterion of irreducibility, Fields, finite fields, field extensions, Galois Theory.	
Text Books	1. Topics in algebra by I. N. Herstein. Wiley Eastern Limited, 2015. 2. A first course in Abstract Algebra by John Fraleigh (3rdEdition), Narossa Publishing House, 2000. 3. Basic Abstract Algebra by Bhattacharya, Jain and Nagpal, 2nd Edition, 2010. 4. Algebra by S.Mclane and G.Birkhoff, 2nd Edition, 5. Basic Algebra by N.Jacbson, Hind.Pub.Corp.2017. 6. Contemporary Abstract Algebra, Joseph A. Gallian, Cengage Learning, 2014. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO203T24	Core Course - 3 M.Sc. Mathematics **Mathematical Programming**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the concept of linear programming problems.	
CO2	Explain PERT and CPM methods.	
CO3	Apply the basic concepts of Game theory.	
CO4	Analyze the significance of the notions of Duality.	
CO5	Evaluate dynamic programming.	
CO6	Develop the applications of different methods.	
Course Content		
Block 1	**Nonlinear optimization**: basic theory, method of Lagrange multipliers, Karush-Kuhn-Tucker theory, Wolfe's mehod as application of Karush-Kuhn-Tucker condition, convex optimization. Numerical optimization techniques: line search methods, gradient methods, Newton's method. Single variables optimizations. Hassian matrix and its applications.	
Block 2	**Project Management:** Historical Development of CPM/PERT, Rules for Drawing Network, CPM: Time estimation and Critical Path in Network, PERT, Probability to complete a Project.	
Block 3	**Integer programming**: Gomory's algorithm for all and mixed integer programming problems, Branch and Bound Algorithms cutting plan algorithm. Dynamic programming: Introduction, Bellman principle of optimality, solution of problems with finite number stages, solution of l.p.p. by dynamic programming. Duality and dual simplex method	
Block 4	**Game Theory**: Two person zero sum game, Game with saddle points, the rule of dominance; Algebric, graphical and linear programming methods for solving mixed strategy games. Sequencing problems: Processing of n jobs through 2 machines, n jobs through 3 machines, 2 jobs through m machines, n jobs through m machines.	
Text Books	1. Operations Research – An Introduction, Handy A Taha – Pearson Education.Operations Research Panneer Selvan Prentice Hall of India,2010. 2. "Operations Research: Theory and Application", J.K.Sharma, Noida: MacMillan India,2003. 3. "Quantitative Techniques in Management", N.D.Vohra, New Delhi: Tata McGraw-Hill Publishing Co. Ltd, 2007. 4. "Operations Research", R.Paneerselvam, New Delhi: Prentice Hall of India, 2008. 5. "Operations Research", Frederick S.Hillier and Gerald J. Lieberman, New Delhi: Tata McGraw Hill, 2005. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO204T24	Core Course - 4 M.Sc. Mathematics **Continuum Mechanics**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the significance of mathematics involved in physical quantities and their uses.	
CO2	Explain the Stokes, Gauss, and Green's theorems.	
CO3	Apply Body forces and surface forces.	
CO4	Classify the Lagrangian and Euler description of the deformation of flow.	
CO5	Evaluate the concept of stress and strain.	
CO6	Develop the geometrical meaning of the components of the linear strain tensor.	
Course Content		
Block 1	Cartesian Tensors, Index notation and transformation laws of Cartesian tensors. Addition, Subtraction and Multiplication of cartesian tensors, Gradient of a scalar function, Divergence of a vector function and Curl of a vector function using the index notation. e-d identity. Conservative vector field and concept of a scalar potential function. Stokes, Gauss and Green's theorems.	
Block 2	Continuum approach, Classification of continuous media, Body forces and surfa forces. Components of stress tensor, Force and Moment equations of equilibriur Transformation law of stress tensor. Stress quadric. Principal stress and principa axes. Stress invariants and stress deviator. Maximum shearing stress, Pain strain Mohr's Circles for strain.	
Block 3	Lagrangian and Eulerian description of deformation of flow. Comoving derivative, Velocity and Acceleration. Continuity equation. Strain tensors. Linear rotation tensor and rotation vector, Analysis of relative displacements.	
Block 4	Geometrical meaning of the components of the linear strain tensor, Properties of linear strain tensors. Principal axes, Theory of linear strain. Linear strain components. Rate of strain tensors. The vorticity tensor. Rate of rotation vector and vorticity, Properties of the rate of strain tensor, Rate of cubical dilation.	
Text Books	1. Continuum Mechanics, Anthony James Merril Spencer, Dover publication,2004. 2. Introduction to Engineering Mechanics A Continuum Approach, Jenn Stroud Rossmann, Clive L. Dym , Taylor and francis group, 2010. 3. Introduction to continuum mechanics for engineers, Ray M. Bowen, dover publication, 2000. 4. First Course in Continuum Mechanics, Y.C. Fung, Prentice Hall, 2017. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMDS201T24	Discipline Specific Elective (DSE) - 1 M.Sc. Mathematics **Computer Application**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the basic concepts of computer hardware and software.	
CO2	Explain the data representation and data processing.	
CO3	Apply various properties of secondary storage devices.	
CO4	Analyze the direct access devices and optical disk.	
CO5	Evaluate factors affecting processing speed.	
CO6	Create backup DOS and windows, UNIX and Linux.	
Course Content		
Block 1	**Introduction**: Need of and features of Computer, Parts of Computer System: Hardware, Software, Data, Users, The information processing cycle. Evolution of Computer Systems & Generations. **Computer hardware**: Processing Devices, Memory Devices: RAM, ROM, Input and Output Devices (Keyboard, Mouse, Pen, Touch Screens, Bar Code Readers, OCR, Printer, Plotters, VDU, Speakers, etc.), Storage Devices: Magnetic and Optical Storage, **Software**: System software, Application Software, Utility software. Programming languages and language translators.	
Block 2	**Data Representation**: Number Systems, Bits and Bytes, Text Codes. Binary/Octal/Hexadecimal Number Systems; Computer Arithmetic. **Data Processing**: The CPU, Machine Cycles, Memory, Factors Affecting Processing Speed, Registers, Memory and Computing Power, Computer's Internal Clock, Bus, Cache Memory.	
Block 3	**Secondary Storage Devices**: Sequential access devices; Magnetic tapes: Types, Basic Principles of operation, advantages, Limitations of magnetic Tapes. **Direct access devices**, Magnetic disks: Types, Basic Principles of operation, advantages, Limitations of magnetic disks. **Optical disks**: Types, Basic Principles of operation, advantages, Limitations of optical disks.	
Block 4	**Operating System**: Purpose of Operating Systems, Types of Operating System, User Interface: Graphical User Interfaces, Command Line Interfaces, Running Programs, Sharing Information, Managing Hardware: Processing Interrupts, Working with Device Drivers, Utility Software, Backup Utilities, Antivirus, Firewall, Intrusion Detection, and Screen Savers. Introduction to PC Operating Systems: DOS and windows, UNIX and Linux.	
Text Books	1. "Introduction to Computers", Norton Peter, 6th Ed., TMH, 2001 2. "DOS Guide", Peter Norton's, Prentice Hall of India,2010. 3. "Computer Fundamentals", P. K. Sinha & Priti Sinha , BPB Publications, 2015. 4. "Introduction to Computers", Alex Leon & Mathews Leon, Vikas Publishing House, 2017. * Latest Edition of all the suggested books are recommended	
Online Resources	Elsevier Computer Science Journals	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMDS202T24	Discipline Specific Elective (DSE) - 2 M.Sc. Mathematics **Differential Geometry**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the vector function to represent space curves and surfaces.	
CO2	Explain the Arc Length, Curvature, Torsion and various other quantities.	
CO3	Apply the physical and geometrical important concepts related to gradient, divergence and curl of vector field.	
CO4	Analyze importance of Green, Gauss and Stokes' theorems in other branches of mathematics.	
CO5	Evaluate integrals of vector valued function over curves, surfaces and domains in two and three-dimensional space.	
CO6	Create vector and tensor calculus in mechanics, fluid flow, heat flow, electrostatics etc.	
Course Content		
Block 1	Tensor and their transformation laws, Tensor algebra, Contraction, Quotient law, Reciprocal tensors, Kronecker delta, Symmetric and skew- symmetric tensors, Metric tensor, Riemannian space, Christoffel symbols and their transformation laws, Covariant differentiation of a tensor, Riemannian curvature tensor and its properties, Ricci-tensor.	
Block 2	Theory of space curves. Serret-Frenet formulas for curves in space. Parametric representation of curves, Helix , Curvilinear coordinates in E3. Tangent and first curvature vector. Intrinsic equations & differentiation, Parallel vector fields**.**	
Block 3	Parametric representation of a surface, Tangent and Normal vector field on a surface, The first and second fundamental tensor. The third fundamental form, Gaussian curvature, Isometry of surfaces, Equation of Gauss, Principal curvature, Normal curvature.	
Block 4	Definition. Differential equation of geodesics. Nature of Geodesics. Canonical equations. Normal property. Geodesic polar coordinate, curvature and torsion.	
Text Books	1. Tensor Calculus and Application to Geometry and Mechanics, I. S. Sokolnikoff, 2000, 2. An Introduction to Differential Geometry, T. T. Wilmore, 2010. 3. Differential Geometry, Bary Spain, Arthur L. Besre, Einstein manifolds, Springer Verlag, Berlin, New York, 2000. 4. A course in differential geometry, Klingenberg.W, Springer-verlag, 2017. 5. Lectures on differential geometry, Stenberg S prentice Hall of india, 2015. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMVA201T24	Value Added Course (VAC)- 1 M.Sc. Mathematics **Biostatistics**	**C - 2**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the Mean, Median, Mode and Measures of Location Quartiles.	
CO2	Explain the Range Deviation, Quartile Deviation etc., Mean Deviation and Variance.	
CO3	Apply the Mean, Median, Mode methods.	
CO4	Analyze the Measures of Central Tendency and Variation for Qualitative Variables.	
CO5	Evaluate integrals of vector valued function over curves, surfaces and domains in two and three-dimensional space.	
CO6	Create Graphical Representation by types of data for univariate and bivariate presentation.	
Course Content		
Block 1	Graphical Representation by types of data for univariate and bivariate presentation.	
Block 2	Measures of Central Tendency and Location – Mean, Median, Mode and Measures of Location Quartiles, Quintiles, Deciles and Percentiles Measures of Dispersion – Range Deviation, Quartile Deviation etc., Mean Deviation, Variance.	
Block 3	Standard Deviation, Coefficient of Variation.	
Block 4	Measures of Central Tendency and Variation for Qualitative Variables Karl Pearson's Coefficients, Correlation and Concepts of Regression..	
Text Books	1. Glover, Thomas and Kevin Mitchell: An Introduction to Biostatistics, 3rd edition. Waveland Press, 2015. **2.** Surender Singh and Deeksha Sharma: Biostatistics and Research Methodology, New Age International (P) Ltd., Publishers, 2020. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO201P24	Core Course Lab - 1 M.Sc. Mathematics **Numerical & Statistical Techniques Lab**	**C - 2**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the numerical methods to obtain approximate solutions of mathematical problems.	
CO2	Explain error, source of error and its affect on any numerical computation and also analyzing the efficiency of any numerical algorithm.	
CO3	Solve system of linear equations numerically using direct and iterative methods.	
CO4	Analyze the accuracy of common numerical methods.	
CO5	Evaluate numerical solution of nonlinear equations using Bisection, Newton – Raphson and fixed-point iteration methods.	
CO6	Create interpolating polynomials with practical exposure.	
Exercises		
Experiment 1	Write programs in C/C++ to implement Floating Point Representation of the following: a) Addition b) Subtraction c) Multiplication d) Division	
Experiment 2	Write programs in C/C++ to implement to implement a) Bisection Method b) Newton Raphson Method c) Regula – Falsi Method	
Experiment 3	Compute the two regression coefficients using the values of actual means of X and Y from the data given below and then work out the values of 'r': X 7 4 8 6 5 Y 6 5 9 8 2	
Experiment 4	Implement the following : a) Newton's Forward Difference Table b) Newton's Backward Difference Table c) Newton's Central Difference Table d) Newton's Forward Interpolation Formula e) Newton's Backward Interpolation Formula f) Newton's Central Difference Interpolation Formula	
Experiment 5	Write a program to implement Jacobi's Method.	
Experiment 6	200 digits were chosen at random from a set of tables. The frequencies of the digits were: Digits 0 1 2 3 4 5 6 7 8 9 Frequencies 18 9 23 21 16 25 22 20 21 15 Use chi-square test to assess the correctness of hypothesis that the digits were	

	distributed in equal numbers in the table
Experiment 7	Write programs in C/C++ to implement the following: a) Gauss – Seidel Method b) Lagrange's Interpolation c) Trapezoidal Rule d) Simpson's 1/3 Rule e) Simpson's 3/8 Rule f) Euler's Method g) Euler's Modified Method h) Runge – Kutta II Order Method i) Runge – Kutta IV Order Method j) Fitting a Straight Line **Tests:** F – Test, T – Test.
Text Books	1. "Numerical Analysis", Sastry S.S., Prentice Hall of India Learning Pvt. Ltd,2015. 2. "Numerical Methods", Balaguruswamy E, McGraw-Hill Publishing Company, New Delhi, 2000. 3. "Applied Numerical Analysis'' Gerald & Wheatley', Addison-Wesley, 2000. 4. "Numerical Methods for Scientific and Engineering Computation, Jain, Iyengar and Jain, New Age International, 2017. Lab * Latest Edition of all the suggested books are recommended
Online Resources	IOP Science Journals, Elsevier Mathematics Journals
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.

Semester III

Course Code: DMSMCO301T24	Core Course - 1 M.Sc. Mathematics **Linear Algebra**	C - 4
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the concepts of vector spaces, subspaces, bases, dimension and their properties.	
CO2	Explain the linear independence for vectors in Rn , rank and nullity of linear transformation.	
CO3	Apply the matrix representing a linear under a given basis, and determine how the matrix changes if the basis is changed.	
CO4	Analyze the characteristic polynomials to compute eigenvalues and eigenvectors.	
CO5	Evaluate definite integral as an inner product, orthogonality of vectors and its use in projecting vectors into subspaces and decomposing vectors into components.	
CO6	Create the theory, methods and techniques of the course to solve mathematical problems.	
Course Content		
Block 1	Vector Spaces, Subspaces, Bases and Dimensions, Linear span, Row space and column space of matrix, Direct Sum, Rank of matrices, Quotient Spaces.	
Block 2	Linear transformations, operation with linear mapping, matrix representations of linear transformations, ,the rank and nullity theorem, Change of basis, similarities, transposes of linear transformations; trace and determinant, eigenvalues and eigenvectors, Dual spaces.	
Block 3	Characteristic polynomial and minimal polynomial, Diagonalisability, Triangularisable, Caley-Hamilton theorem,, The Adjoint of Linear Transformation, Inner Product Spaces, Orthonormal and Orthogonality, Gram-Schmidt orthogonalization process, Schwartzs inequality, Unitary operators, Self Adjoints and Normal Operators, Polar and Singular Value Decomposition**.**	
Block 4	Canonical and Bilinear Forms: Jordan Forms, The Rational Forms, Bilinear Forms, Quadratic form: Definition and Examples, The matrix of a Bilinear Form, Orthogonality, and Classification of Bilinear Forms.	
Text Books	1. Linear algebra by S. Lang, Springer, 2016. 2. Linear Algebra by Bisht and Sahai, Narosa, 2000. 3. Linear Algebra by Hoffman and Kunze, Prentice Hall of India Learning Pvt. Ltd, 2015. 4. Theory and Problems: Linear Algebra, Seymour Lipschutz, McGraw-Hill, 2018. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO302T24	Core Course - 2 M.Sc. Mathematics **Mechanics**	C - 4
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the significance of mathematics involved in physical quantities and their uses.	
CO2	Explain the necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system of coplanar forces acting on a rigid body.	
CO3	Apply the centre of gravity of some materialistic systems and discuss the equilibrium of a uniform cable hanging freely under its own weight.	
CO4	Analyze the kinematics and kinetics of the rectilinear and planar motions of a particle including the constrained oscillatory motions of particles.	
CO5	Evaluate particle moving under a central force describes a plane curve and know the Kepler's laws of the planetary motions, which were deduced by him long before the mathematical theory given by Newton.	
CO6	Create the stress developed in beams due to forces applied.	
Course Content		
Block 1	Vector Integration. Line integrals, Surface area and surface integrals, Volume integrals.	
Block 2	Integral Theorems Green's theorem, Gauss divergence theorem, Stoke's theorem.	
Block 3	Curvilinear Coordinates, Orthogonal coordinates, Unit vectors in curvilinear systems, Arc length and volume elements, The gradient, Divergence and curl Special orthogonal coordinate systems.	
Block 4	Tensor Analysis, Coordinate transformations, Einstein summation convention, Tensors of different ranks Contravariant, Covariant and mixed tensors.	
Text Books	1. Continuum Mechanics, Anthony James Merril Spencer , Dover publication,2004. 2. Introduction to Engineering Mechanics A Continuum Approach, Jenn Stroud Rossmann, Clive L. Dym , Taylor and Francis group,2010. 3. Inroduction to continuum mechanics for engineers, Ray M. Bowen , Dover publication,2010. 4. First Course in Continuum Mechanics, Y.C.Fung, Prentice Hall, 2014. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO303T24	Core Course - 3 M.Sc. Mathematics **Integral Transforms**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the Laplace transform– Definition and its properties. Rules of manipulation. Laplace transform of derivatives and integrals.	
CO2	Explain the Inverse Laplace transform and its properties.	
CO3	Apply Fourier sine, cosine and complex transforms.	
CO4	Analyze Mellin transforms of derivatives and integrals.	
CO5	Evaluate Z transforms and Inverse Z-Transform.	
CO6	Create Fourier transform of derivatives.	
Course Content		
Block 1	Laplace transform– Definition and its properties. Rules of manipulation. Laplace transform of derivatives and integrals. Inverse Laplace transform and its properties. Convolution theorem. Solutions of differential equation with the help of Laplace transform.	
Block 2	Fourier transform – Definition and properties of Fourier sine, cosine and complex transforms. Convolution theorem. Inversion theorems. Fourier transform of derivatives.	
Block 3	Mellin transform– Definition and elementary properties. Mellin transforms of derivatives and integrals. Inversion theorem. Convolution theorem.	
Block 4	Z transforms - Introduction, Properties, and Inverse Z-Transform.	
Text Books	1. Applied Mathematics for Engineers and Physicists by L. A. Pipe (McGraw-Hill),2010 . 2. Introduction to Mathematical Physics by Charlie Harper (Prentice Hall of India),2000 . 3. Higher Engineering Mathematics by B.S. Grewal, Khanna Publications, Delhi,2015. 4. Mathematical Methods for Physicists by George Arfken (Academic Press), 2000. 5. Mathematical Methods by Potter and Goldberg (Prentice Hall of India. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO304T24	Core Course - 4 M.Sc. Mathematics **Advanced Differential Equations**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the physical systems can be described by differential equations.	
CO2	Explain the practical importance of solving differential equations.	
CO3	Apply the differences between initial value and boundary value problems (IVPs and BVPs).	
CO4	Analyze the importance of establishing the existence and uniqueness of solutions.	
CO5	Evaluate an appropriate solution method for a given problem.	
CO6	Create approximate solutions of ODEs using graphical and numerical techniques	
Course Content		
Block 1	Classification of linear partial differential equation of second order, Canonical forms, Characteristics curve,Cauchy'sproblem of first and second order partial differential equation.	
Block 2	General solution of higher order PDEs with constant coefficients, Linear homogeneous boundary value problem, Eigen values and eigen functions, Sturm-Liouville boundary value problems, orthogonality of eigen functions, Lagrange's identity, properties of Eigen functions.	
Block 3	Important theorems of sturm Liouville system, Periodic functions.Non-homogeneous boundary value problems, Non-homogeneous Sturm-Liouville boundary value problems (method of eigen function expansion).	
Block 4	Green's Functions: Non-homogeneous Sturm-Liouville boundary value problem (method of Green's function), Procedure of constructing the Green's function and solution of boundary value problem, properties of Green's function, Inhomogeneous boundary conditions, Dirac delta function, Bilinear formula for Green's function, Modified Green's function.	
Text Books	1. Theory of Ordinary Differential Equations, E. A. Coddington and N. Levinson, Tata McGraw Hill, 2013. 2. Differential Equations, S. L. Ross, 3rd Edn., Wiley India, 2015. 3. Elements of Partial Differential Equations, I. N. Sneddon, Dover Publications, 2006. 4. Partial Differential Equations, F. John, Springer, 2014. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMDS301T24	Discipline Specific Elective (DSE) – 1 M.Sc. Mathematics **Viscous Fluid Dynamics**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the fundamental properties of fluids, including viscosity, Newtonian and non-Newtonian rheology, and viscoelasticity.	
CO2	Explain the necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system of coplanar forces acting on a rigid body.	
CO3	Apply microscopic continuum fluid mechanics where flow is governed by the continuity equation and Navier-Stokes equation.	
CO4	Analyze a problem and arrive at reasonable approximations to put the equations in a more soluble form.	
CO5	Evaluate the significance of mathematics involved in physical quantities and their uses.	
CO6	Create the stress developed in beams due to forces applied.	
Course Content		
Block 1	Viscosity , Analysis of stress and rate of strain, Stoke's law of friction, Thermal conductivity and generalized law of heat conduction, Equations of state and continuity , Navier- Stokes equations of motion and Equation of energy.	
Block 2	Vorticity and circulation, Dynamical similarity, Inspection and dimensional analysis, Buckingham theorem and its application, Non-dimensional parameters and their physical importance : Reynolds number, Froude number, Mach number, Prandtl number, Eckart number, Grashoff number, Brinkmann number, Non – dimensional coefficients : Lift and drag coefficients, Skin friction , Nusselt number, Recovery factor.	
Block 3	Exact solutions of Navier – Stokes equations, Velocity distribution for plane couette flow, Plane Poiseuille flow, Generalized plane Couette flow, Hagen-Poiseuille flow, Flow in tubes of uniform cross-sections. Stokes first and second theorem.	
Block 4	Flow between two concentric rotating cylinders. Stagnation point flows: Hiemenz flow, Homann flow, Flow due to a rotating disc.	
Text Books	1. Viscous Fluid Dynamics J.L. Bansal, Oxford and IBH, 2010. 2. Specifications of Viscous Fingering in Mathematical Fluid Dynamics via Bifurcation: A Functional Analytic Approach (English), Bogdan-Vasile Matioc, Suedwestdeutscher Verlag Fuer Hochschulschriften,2000. 3. Boundary Layer Theory, H. Schlichting, K. Gersten, Springer,2010. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMDS302T24	Discipline Specific Elective (DSE) – 2 M.Sc. Mathematics **Combinatorics and Graph Theory**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the Functions and the Pigeonhole principle. Inclusion and exclusion principle.	
CO2	Explain the Basic terminology, Simple graphs, Multi graphs and Weighted graphs.	
CO3	Apply the Pigeonhole principle. Inclusion and exclusion principle.	
CO4	Analyze a Shortest path in weighted graphs, Eulerian paths and circuits.	
CO5	Evaluate the Thickness and Crossing number.	
CO6	Create a binary relation between Directed graphs and Directed trees.	
Course Content		
Block 1	**Combinatorics** Counting of sets and multisets. Binomial and multinomial numbers. Unordered selection with repetitions, Selection without repetition. Counting objects and functions. Functions and the Pigeonhole principle. Inclusion and exclusion principle.	
Block 2	**Graphs**: Basic terminology, Simple graphs, Multi graphs and Weighted graphs. Walk and connectedness. Paths and circuits. Shortest path in weighted graphs, Eulerian paths and circuits. Hamiltonian paths and circuits.	
Block 3	**Plannar Graphs**: Combinatorial and geometric graphs, Kuratowski's graphs. Euler's formula. Detection of planarity. Geometric dual. Thickness and Crossing number.	
Block 4	**Digraphs**: binary relations, Directed graphs and Directed trees, Arborescence, Polish notation method, Tournaments. Counting of Labeled Trees– Cayley's theorem. Counting methods, Polya's theory.	
Text Books	1. Elements of Discrete Mathematics by C. L. Liu, McGraw-Hill Book Co, 2015. 2. Discrete mathematical structures by Kolman, Busby and Ross, 4th edition Prentice Hall of India. , 2002. 3. Mathematical Structures for Computer Science by J. L. Gersting, (3rd edition), Computer Science Press, New York, 2010. 4. Discrete Mathematics with Graph Theory by Goodaire and Parmenter, Pearson edition.2nd edition, 2015. 5. Graph Theory with Applications to Engineering and Computer Sciences by N. Deo, Prentice Hall of India, 2010. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMVA301T24	Value Added Course (VAC) - 1 M.Sc. Mathematics **Research Methodology**	**C - 2**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall basic concepts of research and its methodologies	
CO2	Explain what research is and what it is not, and the different definitions of research.	
CO3	Apply the criteria of good research and the different types of research.	
CO4	Analyze a purpose statement, a research question or hypothesis, and a research objective identify appropriate research topics.	
CO5	Evaluate primary characteristics of quantitative research and qualitative research.	
CO6	Create appropriate research problem and parameters.	
Course Content		
Block 1	Overview of Research and its Methodologies • Concepts of research, • The need for research, • Types of research, • Steps in conducting research	
Block 2	Literature review • What is literature review? • Why the need for literature review? • How to carry out a literature review?	
Block 3	Selecting and defining a research problem • Problem formulation – why the need for this? • What are the criteria for selecting a problem? • Identifying variables • Evaluating problems • Functions of a hypothesis	
Block 4	Conducting the research • Research activities • Preparations before conducting your research	
Text Books	1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2018. An introduction to Research Methodology, RBSA Publishers. 2. Kothari, C.R., 2019. Research Methodology: Methods and Techniques. New Age International. 3. Cohen, L. Lawrence, M., & Morrison, K. (2015). Research Methods in Education (5th edition), Oxford University Press. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO305P24	Core Course Lab - 1 M.Sc. Mathematics **Optimization Techniques Simulation Lab**	**C - 2**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the Elimination Methods and Interpolation Methods of Unconstrained Optimization	
CO2	Summarize about the concept of OT Simulation.	
CO3	Solve Equality Constraints problems of Constrained Optimization.	
CO4	Analyse and appreciate variety of performance measures for various optimization problems.	
CO5	Evaluate the direct Root Methods of Unconstrained Optimization.	
CO6	Build the basic concepts of mathematics to formulate an optimization problem.	
Exercises		
Experiment 1	**Linear Programming (Simplex Method)** **Problem**: Maximize the objective function $Z=3x_1+2x_2$subject to the constraints: $x_1+x_2\leq 4, x_1\geq 0, x_2\geq 0$ Use the Simplex method to find the optimal solution.	
Experiment 2	**Quadratic Programming** **Problem**: Minimize the objective function $Z = x_1^2 + x_2^2$ subject to the constraints: $x_1+x_2=5, x_1\geq 0, x_2\geq 0$ Use a suitable quadratic programming method to find the minimum value of Z.	
Experiment 3	**Unconstrained Optimization (Gradient Descent)** **Problem**: Minimize the function $f(x)=x^2+6x+5$ using the gradient descent method. Set the initial guess $x_0=3x$ and choose a learning rate of 0.1.	
Experiment 4	**Constrained Optimization (Lagrange Multiplier)** **Problem**: Maximize the function $f(x,y)=x^2+y^2$ subject to the constraint x+y=10. Use the method of Lagrange multipliers to find the optimal points.	
Experiment 5	**Integer Linear Programming**	

	Problem: Maximize the objective function $Z=4x+3y$ subject to the constraints: $x+2y\leq10, 3x+y\leq12$ Solve this problem using integer programming techniques, ensuring that x and yare integers.
Experiment 6	**Nonlinear Programming (Newton's Method)** **Problem**: Minimize the function $f(x)=x^2-4x+4$ using Newton's method. Use the initial guess $x_0=3$.
Experiment 7	**Constrained Optimization (KKT Conditions)** **Problem**: Minimize $f(x,y)=x^2+y^2$ subject to the constraint $x+y=1$ using the Karush-Kuhn-Tucker (KKT) conditions.
Experiment 8	**Nonlinear Constrained Optimization (Penalty Method)** **Problem**: Minimize $f(x)=(x-2)^2$ subject to the constraint $x\geq1$ using the penalty method. Introduce a penalty function for the constraint violation.
Text Books	1. Operation Research: S. D. Sharma; KedarNath R.& Com' Meerut, 2019. 2. Optimization Technique: Jain K.C., Rawat M. L., CBC, 2020. 3. Optimization Technique: Mehta D.M., 2018. 4. Operation Research 5th Ed.: Kapoor V. K.;Sultan Chand & sons, 2019. 5. Introduction to Operation Research-A Computer Oriented Algorithmic Approach: Gillet B. E.; Tata McGraw-Hill, 2017. * Latest Edition of all the suggested books are recommended
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.

Semester IV

Course Code: DMSMCO401T24	Core Course - 1 M.Sc. Mathematics **Functional Analysis**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the research, inquiry and analytical thinking abilities of the students.	
CO2	Explain the independently use contractions of Banach spaces via fixed point theorems.	
CO3	Apply the applications in the real world.	
CO4	Analyze topological-algebraical structures	
CO5	Evaluate analytical methods.	
CO6	Create the problems in diverse situations in physics, engineering etc.	
Course Content		
Block 1	Normed linear spaces. Quotient space of normed linear spaces and its completeness. Banach spaces and examples. Bounded linear transformations. Normed linear space of bounded linear transformations.	
Block 2	Equivalent norms. Basic properties of finite dimensional normed linear spaces and compactness.Reisz Lemma. Multilinear mapping. Open mapping theorem. Closed graph theorem. Uniformboundness theorem.	
Block 3	Continuous linear functionals. Hahn-Banach theorem and its consequences. Embedding andReflexivity of normed spaces. Dual spaces with examples. Inner product spaces. Hilbert space and its properties. Orthogonality and Functionals in Hilbert Spaces.	
Block 4	Phythagorean theorem, Projection theorem,Orthonormal sets, Bessel's inequality, Complete orthonormal sets, Parseval's identity, Structure of a Hilbert space, Riesz representation theorem, Reflexivity of Hilbert spaces, Adjoint of an operator on a Hilbert space, Self-adjoint, Positive, Normal and Unitary operators and their properties, Projection on a Hilbert space, Invariance, Reducibility, Orthogonal projections.	
Text Books	1. Functional Analysis, B. V. Limaye, 7th edition, Wiley Eastern, 2020. 2. Introduction to Functional Analysis with Applications, E. Kreyszig John Wiley and Sons, 2018. 3.ACourse in Functional Analysis, J.B. Conway, Springer, 2019. 4. R. Bhatia, Notes on Functional Analysis, Hindustan Book Agency, India, 2019. 5. M. Schechter, Principles of Functional Analysis, Second Edition, American Mathematical Society, 2018. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO402T24	Core Course - 2 M.Sc. Mathematics **Integral Equations**	C - 4
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall various algebraic structures.	
CO2	Explain the concept of integral equations.	
CO3	Apply the basic concepts to develop theorems.	
CO4	Analyze the significance of the notions of integral equations.	
CO5	Evaluate the fundamental concepts of integral equations.	
CO6	Create Different methods to solve integral equations.	
Course Content		
Block 1	Linear integral equations– Definition and classification, Conversion of initial and boundary value problems to an integral equation, Eigen values and Eigen functions, Solution of homogeneous and general Fredholm integral equations of second kind with separable kernels.	
Block 2	Solution of Fredholm and Volterra integral equations of second kind by methods of successive substitutions and successive approximations, Resolvent kernel and its results, Conditions of uniform convergence and uniqueness of series solution.	
Block 3	Integral equations with symmetric kernels– Orthogonal system of functions, Fundamental properties of eigen values and eigen functions for symmetric kernels, Expansion in eigen functions and bilinear form, Hilbert-Schmidt theorem, Solution of Fredholm integral equations of second kind by using Hilbert-Schmidt theorem.	
Block 4	Solution of Volterra integral equations of second kind with convolution type kernels by LaplaceTransform, Solution of singular integral equations by Fourier transform, Classical Fredholm theory– Fredholm theorems, Solution of Fredholm integral equation of second kind by using Fredholm first theorem.	
Text Books	1. Integral Equations, F.G Tricomi, Dover Publications Inc. New York, 2014. 2.Integral Equations: A Practical Treatment from Spectral Theory to Applications, D. Porter and D.S.G. Stirling, Cambridge University Press, 2015. 3.Singular Integral Equations, N.I. Muskhelishvili, Dover Publications Inc., New York, 2008., J.B. Conway, Springer, 2010 * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO403T24	Core Course - 3 M.Sc. Mathematics **Complex Analysis**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the fundamental concepts of complex analysis.	
CO2	Explain the accurate and efficient use of complex analysis Techniques.	
CO3	Apply problem-solving techniques using complex analysis.	
CO4	Analyze the significance of the notions of Complex plane.	
CO5	Evaluate different problems of complex physics.	
CO6	Create the applications of different methods.	
Course Content		
Block 1	Functions of a complex Variable, Differentiability and analyticity, Cauchy Riemann Equations, Harmonic functions, Existence of Harmonic conjugate, Power series as an analytic function, properties of line integrals, Goursat Theorem, Cauchy theorem, consequence of simply connectivity, index of a closed curve .	
Block 2	Cauchy's integral formula, Morera's theorem, Liouville's theorem, Fundamental theorem of Algebra,Taylor's theorem, Laurent series, Power series and its radius of convergence.	
Block 3	Zeros of Analytic functions, singularities, classification of singularities,Maximum modulus theorem, Minimum modulus theorem, Hadamard three circle theorem, Schwarz's Lemma, Rouche's theorem.	
Block 4	Calculation of residues, Residue theorem and its applications in evaluating real integrals,Conformal mappings, critical points. Bilinear transformation, their properties and classification, cross ratio, preservance of cross ratio under bilinear transformation, preservance of circle and straight line under bilinear transformation, fixed point bilinear transformation, normal form of a bilinear transformation.	
Text Books	1. Complex Analysis (Third edition) by L. V. Ahlfors, McGraw-Hill Book Company, 2015. 2. Complex Analysis by J. B. Conway, Narosa Publishing House, 2010. 3. Complex Analysis by Serg Lang, Addison Wesley, 2015. 4. Foundations of Complex analysis (Second Edition), S. Ponnusamy, Narosa Publishing House, 2010. 4. Complex variables and Applications by Ruel V. Churchill, 2015. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO404T24	Core Course - 4 M.Sc. Mathematics **Number Theory**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the Mathematical concepts and principles to perform symbolic computations.	
CO2	Explain the technology appropriately to investigate and solve mathematical and statistical problems.	
CO3	Apply proofs effectively in both written and oral forms.	
CO4	Analyze the ability to learn number theory concepts.	
CO5	Evaluate different problems of number theory.	
CO6	Create the applications of different methods.	
Course Content		
Block 1	Divisibility, G.C.D and L.C.M., Primes, Fermat numbers, congruences and residues, theorems of Euler, Fermat and Wilson, solutions of congruences, linea congruences, Chinese remainder theorem.	
Block 2	Arithmetical functions $\varphi(n)$, $\mu(n)$ and $d(n)$and $\sigma(n)$, Moebius inversion formula, congruences of higher degree, congruences of prime power modulli and prime modulus, power residue.	
Block 3	Quadratic residue, Legendre symbols, lemma of Guass and reciprocity law. Jacobi symbols, Farey series, rational approximation, Hurwitz theorem, irrational numbers, irrationality of e and π, Representation of the real numbers by decimals.	
Block 4	Finite continued fractions, simple continued fractions, infinite simple continued fractions, periodic continued fractions, approximation by convergence, best possible approximation, Pell's equations, Lagrange four sphere theorem.	
Text Books	1. Theory of Numbers, G H Hardy and E M Wright, Oxford Science Publications, 2003. 2. Introduction to the Theory of Numbers, I Niven and H S Zuckerman, John Wiley & Sons, 2016. 3. Elementary Number Theory, D M Burton, Tata McGraw Hill Publishing House, 2006. 4. Higher Arithmetic, H. Davenport, Cambridge University Press, 2000. 5. Introduction to Analytic Number Theory, T.M. Apostal, Narosa Publishing House, 2015. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMDS401T24	Discipline Specific Elective - 1 M.Sc. Mathematics **Difference Equations and Sampling Theory**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the significance of Difference Equations.	
CO2	Explain the Sampling Theory.	
CO3	Apply the importance of mathematics and its techniques to solve real life problems.	
CO4	Analyze the limitations of such techniques and the validity of the results.	
CO5	Evaluate the application of Difference equations in Numerical methods.	
CO6	Create the geometrical meaning of the Difference equations.	
Course Content		
Block 1	Introduction, Difference Calculus – The difference operator, Summation, Generating functions and approximate summation. Linear Difference Equations - First order equations. General results for linear equations.	
Block 2	Equations with constant coefficients. Applications. Equations with variable coefficients. Stability Theory - Initial value problems for linear systems. Stability of linear systems.	
Block 3	Sample space, Events, Algebra of events, Baye's Rule, Bernoulli Trials. Probability Distribution and probability Densities.	
Block 4	Bernoulli, Binomial, Poisson, Normal, Rectangular and exponential distributions and their PDFs. Moments and MGFs for above distributions.	
Text Books	1. " Mathematical Methods"-Potter, M C; Goldberg Jack, PHI,2010 2. Probability and Statist**ics" – Schaum's Series** – McGraw Hill,2015. 3. Walter G. Kelley and Allan C. Peterson- Difference Equations. An Introduction with Applications, Academic Press Inc., Harcourt Brace Joranovich Publishers, 2014. 4. Calvin Ahlbrandt and Allan C. Peterson. Discrete Hamiltonian Systems, Difference Equations, Continued Fractions and Riccatti Equations. Kluwer, Boston, 2015. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMDS402T24	Discipline Specific Elective - 2 M.Sc. Mathematics **Mathematical Statistics**	**C - 4**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Recall the dependent, independent, compound events, addition and multiplication theorems of probability.	
CO2	Explain the Binomial & Poisson distributions and their properties.	
CO3	Apply the Fitting of the Curves by method of least square.	
CO4	Analyze the Parameters & Statistics, Null Hypothesis, Level of Significance and critical region.	
CO5	Evaluate the Coefficient of Correlation, rank of correlation and lines of regression.	
CO6	Create the Procedure for testing Hypothesis.	
Course Content		
Block 1	**Probability Theory:** Three definitions of probability (Mathematical, Empirical & axiomatic). Dependent, independent and compound events. Addition and multiplication theorems of probability, conditional probability. Binomial and multinomial theorems of probability, Baye's theorem, Mathematical expectation and its properties, Moment generating functions (m.g.f.) and cumulants.	
Block 2	**Discrete distribution**– Binomial & Poisson distributions and their properties. Continuous distribution: – Distribution function, Probability density function (Pdf), Cauchy's distribution, rectangular distribution, exponential distribution, Beta, Gamma Normal distributions and their properties. Fitting of the Curves by method of least square – Straight line, parabola and exponential curves.	
Block 3	**Correlation and Regression**: Bivariate population, Meaning of correlation & regression. Coefficient of Correlation, rank correlation, lines of regression. Properties of regression coefficients, Partial and multiple correlation and their simple Properties.	
Block 4	Types of population, Parameters & Statistics, Null Hypothesis, Level of Significance, critical region. Procedure for testing Hypothesis. Type I & Type II error, Chi Square - distribution and its properties.	
Text Books	1. A.M. Goon, M. K. Gupta and B. Dasgupta, Fundamentals of Statistics, Vol I and II, World Press, 2005. 2. J. D. Gibbons, Non-parametric Statistical Inference, McGraw-Hill Inc, 2015. 3. R. V. Hogg, J. McKean and A. Craig, Introduction to Mathematical Statistics, 7th Edition, Pearson, 2012. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMVA401T24	Value Added Course - 1 M.Sc. Mathematics **SCIENTIFIC WRITING AND ACADEMIC INTEGRITY**	**C - 2**
Course Outcome	**On completion of the course, the students will be able to**	
CO1	Identify scientific documents using their improved scientific writing skills.	
CO2	Summarize accepted methods for literature discussion, citing and quoting to written scientific documents, while avoiding plagiarism.	
CO3	Use a good, solid draft of the specific aims and background related to their Master's Thesis, PhD research proposal and other academic work.	
CO4	Present their research work in written and oral form by integrating, analysing and applying key texts and practices	
CO5	Justifying a decision or course of action.	
CO6	Develop their career in pharmaceutical/industrial laboratories and also as the project assistant in government funded project.	
Course Content		
Block 1	Scientific writing: An introduction, key principles of effective writing and Characteristics of scientific writing.	
Block 2	Elements of the scientific paper and poster, the anatomy of a table, anatomy of a figure, using of active verbs, citation and referencing, citation types.	
Block 3	Peer review process, ethical issues in scientific publishing and how to avoid plagiarism.	
Block 4	Determine authorship, submit a paper, write a peer review and their types, and avoid predatory journals.	
Text Books	1. Communicating science effectively: a research agenda, Washington, DC: the National Academies Press, 2017. 2. Communicate science papers, presentations, and posters effectively: papers, posters, and presentations, London: Academic Press, an imprint of Elsevier, 2015. 3. Systematic approaches to a successful literature review, Los Angeles: Sage, 2016, second edition. 4. Doing a systematic review: a student's guide, London SAGE, 2017, second edition. 5. Handbook of Academic Integrity (Bretag, Tracey (Ed.), 2016, Springer Singapore. * Latest Edition of all the suggested books are recommended	
Online Resources	IOP Science Journals, Elsevier Mathematics Journals.	
Learner Support Material	NPTL, Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.	

Course Code: DMSMCO405P24	M.Sc. Mathematics – Semester – IV Dissertation Report Evaluation (Based on : Specific Mathematical Problems)	C - 6
Course Outcomes	**On completion of the course, the students will be :**	
CO1.	Assessing the probable solution to a given research problem.	
CO2.	Collect, analyze, and synthesize relevant literature and research finding	
CO3.	Apply advanced mathematical theories and concepts to solve problems.	
CO4.	Analyze the results to prove their findings.	
CO5.	Writing a report with effectiveness.	
CO6.	Demonstrate the ability to conduct independent research in a specific area of mathematics.	
Course Content	1. Selection of research topics: Based on Integral Transform/ Viscous Fluid Dynamics/ Numerical Methods etc. • Identifying research gaps. • Feasibility and relevance. 2. Literature Review: • Analyzing previous research related to their topic. • Identifying methodologies used in prior studies. • Establishing a theoretical framework for their research. 3. Research Methodology: • Theoretical research. • Choosing appropriate research methodologies. 4. Mathematical Foundations: • In-depth study of mathematical theories related to research. • Relevant software and tools (e.g., MATLAB, LATEX etc.). 5. Data Analysis and Interpretation: • Synthesis of results and findings • Visualization of data and results	
	Note: 1. At the end of the third semester, students have to inform the program coordinator about the area of interest. The student will submit a detailed report at the end of the fourth semester, which will form part of the fourth semester examination. 2. The student will select a research paper from a reputed journal. By using various tools, he will validate the results of the research paper. 3. The student will compare the findings with the research article and critically evaluate the findings.	

	4. The student will submit a detailed report of his work. 5. The report should be in Times New Roman font size 12 and double spacing.
	Students will give a presentation on their work to a panel of external expert and internal faculty members.

Evaluation Scheme

Detail	Record	Presentation	Viva Voce	Total
Internal	10	10	10	30
External	50	10	10	70

Format of Dissertation Report Evaluation
(Based on: Specific Mathematical Problems)

S. No.	Detail
1	Title of the Report

A
Dissertation
Submitted to the
JAIPUR NATIONAL UNIVERSITY

For The Degree Of
Master Of Science (Mathematics)
Year
Department Of Mathematics
School Of Life And Basic Sciences

Under the Guidance **Submitted by**

Guide Name — Student Name
Designation — M.Sc.-Mathematics
Department of Mathematics — Enrolment No.: …….

2	Certificate by Guide/ Department
3	Acknowledgement
4	Table of content (Index) –with page numbers clearly identified

Important Note

Student has to finalize the topic of the dissertation in consultation with faculty guide (Internal).

S. No.	Problem Centered Training	Required number of Pages
1	Chapter -1: Introduction to the topic	4-6
2	Chapter 2: Literature review	4-6
3	Chapter 3: Findings and Learning outcomes	20-25
4	Chapter – 4: Challenges and Limitations faced by the student during solving problems	1-3

5	Chapter – 5: Future Scope of your learning	3-5
6	Chapter – 6: Conclusion/ Summary	3-5
7	References/ Bibliography	6-7
Plagiarism check will be done as per norms provided by the Examination Division of the University.		

Annexure II- Mandatory Documents for Admission

To be uploaded on the Admission Portal by the Prospective students

Admission Documents	Format (Jpeg/PNG/PDF)	Documents Size
Duly filled application form with student signature	Digital signature/Student signature JPEG/PNG	20 KB
Colour scan copy of all year/semester mark sheet/grade cards (for PG programs only) or consolidated mark sheet/grade cards also accepted.	PDF/JPEG	500 KB
Colour scan copy of 10th std. Mark sheet/grade card	PDF/JPEG	
Colour scan copy of 12th std./ Three-Year Polytechnic Diploma Mark sheet/grade card	PDF/JPEG	
Colour scan copy of passport size photograph	JPEG or PNG Format	50 KB
Colour scan copy of Govt. Photo id proof, Aadhar card is mandatory. (Other options: Voter's id, Driving License, Passport etc.)	PDF/JPEG	100 KB
In case of name change, Gazette notification documents for name changes For married women – marriage certificate would be accepted – provided previous maiden name is clearly mentioned in the same. In case of deferred Father name or mother name in such cases without a Gazette notification document.	PDF	500 KB
Fees submission transaction details or receipt as per University policy for respective Distance programs	PDF/JPEG	500 KB
Digitally Signed undertaking as per the process; where applicable	PDF	500 KB

Students can also visit the University website for the said information.

Annexure III- Academic Bank of Credit Id Creation Process

All enrolled students, particularly those of Indian nationality, are required to register with ABC (Academic Bank of Credits), a central scheme established by the Ministry of Education, Government of India, for depositing credit. ABC ID creation is mandatory for all students, ensuring their participation in this scheme.

The ABC Id can be created by students themselves using Digi-locker, UMANG application, ABC portal or Academic Institution Portal. The process for which is provided below.

Process	• Students can register by logging in at www.abc.digilocker.gov.in • Click on My Account → Login as Student • Click on "Sign up with DigiLocker" → Enter valid mobile number → An OTP is sent at the phone number via SMS → Enter the OTP and click on "Continue" button → Enter Security PIN set created during Sign Up and click "Submit" Button • You will be prompted with ABC student account creation window
Documents and proofs required	• Aadhaar Card is mandatory for ABC Id creation • Learners Name • Date of Birth • Gender • Enrolment Number • Requirements by Academic Institution: • Mobile Number

The University will extend support to the students to create ABC ID. The documents required will remain the same as stated above.

Annexure IV – Continuous Internal Assessment Pattern

Particular	A1 (Objective Type)	A2 (Objective Type)
Marks	15	15

Question Pattern for the CIA Components
A-1 1.There will be 15 Objective type Multiple Choice Questions (MCQs), each carrying mark1 mark 2. The time for the A-1 assignment will be 30 mins 3. All questions are compulsory 4. There will be NO NEGATIVE MARKING for the wrong answers. **A-2** 1. There will be 15 Objective type Multiple Choice Questions (MCQs), each carrying mark1 mark 2. The time for the A-1 assignment will be 30 mins 3. All questions are compulsory 4. There will be NO NEGATIVE MARKING for the wrong answers.

Annexure V– End-term Examination Pattern

JNU

Centre for Distance and Online Education

End Term Examination

[PROGRAM NAME]

[COURSE NAME][COURSE CODE]

Time : 2 Hours	Max. Marks : 70
Note for students: The paper will comprises of 70 compulsory objective questions of 1 mark each.	
Answer all the questions. Each question carries one mark.	
Q. No. 1 to Q. No. 70 - Objective questions with four multiple choices.	