M.Sc. (Mathematics) Semester-wise course description:

The academic program at M.Sc. level is through a semester examination scheme. The course work includes lectures, seminars and quiz/laboratory activities.

The full course is of **FOUR SEMESTERS** spread for **TWO YEARS** duration. A semester-wise list of courses to be offered is given below:

SEMESTER- I

MSMT-111: Algebra – I
MSMT-112: Advanced Real Analysis
MSMT- 113: Differential Equations
MSMT-114: Special Functions
MSMT-115: Analytical Dynamics and Numerical Analysis - I

SEMESTER – II

MSMT- 211: Algebra – II
MSMT- 212: Measure Theory and Integration
MSMT- 213: Hydrodynamics
MSMT- 214: Classical Polynomials and Integral Transforms
MSMT- 215: Analytical Dynamics and Numerical Analysis - II

SEMESTER - III

MSMT- 311: Complex Analysis
MSMT- 312: Tensor Analysis
MSMT- 313: Functional Analysis – I
MSMT-314: Any one from Elective Course from **Group – A***
MSMT-315: Any one from Elective Courses from **Group – B***

SEMESTER – IV

MSMT-411: Topology
MSMT- 412: Differential Geometry
MSMT- 413: Functional Analysis – II
MSMT-414: Any one from Elective Courses from **Group – A***
MSMT-415: Any one from Elective Courses from **Group – B***

List of Skill Courses (SC) in Mathematics

MSM SC – 1 : Knowledge of Basic software- I
MSM SC – 2: Knowledge of Basic software –II
MSM SC – 3 : Knowledge of SPSS – I
MSM SC – 4 : Knowledge of SPSS – II
MSM SC – 5 : Sampling and test of Significance – I

***List of Elective Papers 314 & 315 (for Semester – III)**

Group – A	**Group – B**
314(a) Magnetofluid Dynamics - I	315(a) Generalized Functions - I
314(b) Linear Operators in Hilbert Space-I	315(b)Fundamental of Operations Research-I
314(c) Laminar Viscous Flow Theory-I	315(c)Integral Equations and Boundary Value Problems-I
314(d) Probability and Statistical Distributions-I	315(d) Advanced Numerical Analysis – I

***List of Elective Papers 414 & 415 (for Semester – IV)**

Group – A	**Group – B**
414(a)Magnetofluid Dynamics - II	415(a) Generalized Functions - II
414(b)Linear Operators in Hilbert Space-II	415(b) Fundamental of Operations Research-II
414(c)Laminar Viscous Flow Theory-II	415(c) Integral Equations and Boundary Value Problems-I
414(d).Probability and Statistical Distributions-II	415(d) Advanced Numerical Analysis - II

Not more than 33% of the total admitted students of M.A./M.Sc. (Final) Mathematics will be allowed in any elective paper.

Selection of these elective papers will be strictly on merit, obtained in M.A./M.Sc. (Previous) Mathematics Examinations.

GUIDELINES FOR CHOICE BASED CREDIT SYSTEM:

Definitions of Key Words:

1. **Academic Year**: Two consecutive (one odd + one even) semesters constitute one academic year.
2. **Choice Based Credit System (CBCS):** The CBCS provides choice for students to select from the prescribed elective and skill courses. A student need to select **two elective papers** offered by the Department in which he/she is doing core course this shall be part of core programme during third and fourth semester. **Each student has to complete four skill courses: two within the department ant two from other department within LMCST**
3. **Course**: Usually referred to, as 'papers' is a component of a programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/ tutorials/laboratory work/ field work/ project work/ self-study etc. or a combination of some of these.
4. **Credit Based Semester System (CBSS)**: Under the CBSS, the requirement for awarding a degree is prescribed in terms of **number of credits to be completed by the students.**
5. **Credit Point**: It is the **product of grade point and number of credits for a course.**
6. **Credit**: **A unit by which the course work is measured.** It determines the number of hours of instructions required per week. **One credit is equivalent to one period of teaching** (lecture or tutorial) or two periods of practical work/field work per week.
7. **Cumulative Grade Point Average (CGPA)**: It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.
8. **Grade Point**: It is a numerical weight allotted to each letter grade on a 10-point scale.
9. **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F.
10. **Programme**: An educational programme leading to award of the Postgraduate Degree in the Core subject in which he/she is admitted.
11. **Semester Grade Point Average (SGPA)**: It is a measure of performance of work done in a semester. **It is ratio of total credit points secured by a student** in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.
12. **Semester**: Each semester will consist of 15-18 weeks of academic work **equivalent to 90 actual teaching days.** The odd semester may be scheduled from **July to November/ December and even semester from December/January to May**.
13. **Transcript or Grade Card or Certificate:** Based on the grades earned, a statement of grades obtained shall be issued to all the **registered students after every semester.** This statement will display the course details (**code, title, number of credits, grade secured)** along with SGPA of that semester and **CGPA earned** till that semester

Fairness in Assessment

Assessment is an integral part of system of education as it is instrumental in identifying and certifying the academic standards accomplished by a student and projecting them far and wide as an objective and impartial indicator of a student's performance. Accordingly the Faculty of Science resolves the following:

- **a.** All internal assessments shall be open assessment system only and that are based on Quizzes, Subjective test and seminar**.**
- **b.** Attendance shall carry the prescribed marks in all papers and Practical examination CCA (Continuous Comprehensive Assessment).
- **c.** In each semester **three out of five theoretical component College examinations shall be undertaken by external examiners from outside the college** conducting examination, who may be appointed by the competent authority.

Grievances and Redressal Mechanism

a) The students will have the right to make an appeal against any component of evaluation. Such appeal has to be made to the Head/Principal of the College or the Chairperson of the University Department concerned as the case may be clearly stating in writing the reason(s) for the complaint / appeal.

b) The appeal will be assessed by the Chairman and he/she shall place before the **Grievance Redressal Committee (GRC),** Chaired by the Dean, Faculty of Science comprising all HODs of the Faculty and if need be Course Teacher(s) be called for suitable explanation; GRC shall meet at least once in a semester and prior to CCA finalization.

c) The Committee will consider the case and may give a personal hearing to the appellant before deciding the case. The decision of the Committee will be final.

Table 1: Grades and Grade Points

S.No.	Letter Grade	Meaning	Grade Point
1	'O'	Outstanding	10
2	'A+'	Excellent	9
3	'A'	Very Good	8
4	'B+'	Good	7
5	'B'	Above Average	6
6	'C'	Average	5
7	'P'	Pass	4
8	'F'	Fail	0
9	'Ab'	Absent	0

i. A student obtaining Grade F in a paper shall be **considered failed and will be required to reappear in the University End Semester examination.**

ii. For **noncredit courses** (Skill Courses) '**Satisfactory' or "Unsatisfactory**' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA

Grade Point assignment

= and > 95 % marks Grade Point 10.0
90 to less than 95 % marks Grade Point 9.5
85 to less than 90 % marks Grade Point 9.0
80 to less than 85 % marks Grade Point 8.5
75 to less than 80 % marks Grade Point 8.0
70 to less than 75 % marks Grade Point 7.5
65 to less than 70 % marks Grade Point 7.0
60 to less than 65 % marks Grade Point 6.5
55 to less than 60 % marks Grade Point 6.0
50 to less than 55 % marks Grade Point 5.5
45to less than 50 % marks Grade Point 5.0
40 to less than 45 % marks Grade Point 4.5
35 to less than 40 % marks Grade Point 4.0

Computation of SGPA and CGPA:

i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student,

i.e.

$$\textbf{SGPA}\ (Si) = \Sigma\ (Ci \times Gi) / \Sigma Ci$$

Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme,

i.e.

$$\textbf{CGPA} = \Sigma\ (Ci \times Si) / \Sigma\ Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

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

Illustration for SGPA

S.No.	Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade)
1	Course 1	6	**B**	**6**	**6 x 6 = 36**
2	Course 2	6	**B+**	**7**	**6 X 7 = 42**
3	Course 3	6	**B**	**6**	**6 X 6 = 36**
4	Course 4	6	**O**	**10**	**6 X 10 = 60**
5	Course 5	6	**C**	**5**	**6 X 5 = 30**
	Total	**30**			**204**

Thus, **SGPA = 204 / 30 = 6.8**

***Illustration* for CGPA**

	Semester- I	Semester-II	Semester-III	Semester-IV
Credit	**30**	**30**	**30**	**30**
SGPA	**6.67**	**7.25**	**7**	**6.25**

CGPA = (30X6.67+ 30X 7.25 + 30X7 + 30 X 6.25)/120
815.1/120 = 6.79

SEMESTER-WISE THEORY PAPERS / SKILL COMPONENT:

Core Courses	Course code	Title of the Course	Lecture-Tutorial-Practical/ Week	No. of credits	Continuous Comprehensive Assessment (CCA)	End-Semester Examination (ESE) [University Examination]	Total
Semester I							
Course- 1	MSMT-111	Algebra – I	6-0-0	6	30	70	100
Course- 2	MSMT-112	Advanced Real Analysis	6-0-0	6	30	70	100
Course- 3	MSMT-113	Differential Equations	6-0-0	6	30	70	100
Course- 4	MSMT-114	Special Functions	6-0-0	6	30	70	100
Course- 5	MSMT-115	Analytical Dynamics and Numerical Analysis- I	6-0-0	6	30	70	100
Skill Course I*	As per the list		2-0-2				
Total				30	150	350	500
Semester II							
Course- 6	MSMT-211	Algebra - II	6-0-0	6	30	70	100
Course- 7	MSMT-212	Measure Theory and Integration	6-0-0	6	30	70	100
Course- 8	MSMT-213	Hydrodynamics	6-0-0	6	30	70	100
Course- 9	MSMT-214	Classical Polynomials and Integral Transforms	6-0-0	6	30	70	100
Course- 10	MSMT-215	Analytical Dynamics and Numerical Analysis- II	6-0-0	6	30	70	100
Skill course II*	As per the list		2-0-2				
Total				30	150	350	500
Semester III							
Course- 11	MSMT-311	Complex Analysis	6-0-0	6	30	70	100
Course- 12	MSMT-312	Tensor Analysis	6-0-0	6	30	70	100
Course- 13	MSMT-313	Functional Analysis – I	6-0-0	6	30	70	100
Course- 14	MSMT-314	Any one from Elective Courses from **Group – A****	6-0-0	6	30	70	100
Course- 15	MSMT-315	Any one from Elective Courses from **Group – B****	6-0-0	6	30	70	100
Skill course – III*	As per the list		2-0-2				
Total				30	150	350	500
Semester IV							
Course- 16	MSMT-411	Topology	6-0-0	6	30	70	100
Course- 17	MSMT-412	Differential Geometry	6-0-0	6	30	70	100
Course- 18	MSMT-413	Functional Analysis – II	6-0-0	6	30	70	100
Course- 19	MSMT-414	Any one from Elective Courses from **Group – A****	6-0-0	6	30	70	100
Course- 20	MSMT-415	Any one from Elective Courses from **Group – B****	6-0-0	6	30	70	100
Skill course – IV*	As per the list		2-0-2				
Total				30	150	350	500

*** The College shall offer two skill courses per semester from the list of skill courses approved for the college.**

Course Evaluation (Evaluation of the Students)

All courses (Core/ Elective) involve an evaluation system of students that has the following two components:-

(i) **Continuous Comprehensive Assessment (CCA)** accounting for 30% of the final grade that a student gets in a course; and

(ii) **End-Semester Examination (ESE)** accounting for the remaining 70% of the final grade that the student gets in a course.

(i) **Continuous Comprehensive Assessment (CCA)**: This would have the following components:

a. **Quizzes:** Two Quiz examinations of 45 minutes duration each having a maximum of 25 marks shall be arranged for each theory paper during the semester course period

b. Term Test: One term test shall be arranged for each theory paper prior to End-Semester Examination; examination duration shall be of three hours; maximum marks shall be 70

c. **Seminar**: Each student shall prepare and deliver a seminar per theory paper; maximum marks shall be **25**. The seminar shall commence after first quiz examination and shall be completed prior to term test for all the papers.

d. **Classroom Attendance –** Each student will have to attend a minimum of 75% Lectures / Tutorials / Practicals. **A student having less than 75% attendance will not be allowed to appear in the End-Semester Examination (ESE).** Attendance shall have **15 marks** and will be awarded by following the system proposed below:

Those having greater than 75% attendance (for those participating in Co-curricular activities, 25% will be added to per cent attendance) will be awarded CCA marks as follows:-

75% to 80%	=	**3** marks
80% to 85%	=	**6** marks
85 to 90%	=	**9** marks
90% to 95%	=	**12** marks
> 95%	=	**15** marks

Each student's cumulative attendance shall be displayed in the Department Notice Board every month with a copy to the Principal of the college. Condonation of shortage of attendance shall be governed by the principal which is limited upto 5% provided the student produces valid reason for the same.

e. CCA are based on open evaluation system without any bias to any student

f. Any grievance received in the Department from student shall be placed before the **Grievance Redressal Committee** with adjudicated comments

Each component marks will be added without rounding and the total thus obtained is ratio by a factor of six. This value shall be rounded.

Illustration: Quiz 1 – Marks obtained = 20
Quiz 2 – Marks obtained = 18
Term Test Marks obtained= 50.5
Seminar Marks obtained = 14
Attendance Marks obtained = 9
Total = 111.5
Conversion = 111.5/5 = 22.3
Award (Rounded off to next integer) = 23.00

Skill Course Evaluation: Based on his/her performance and hands on practice, the respective Department shall declare the result as "Satisfactory" or "Non-Satisfactory"; each student need to get a minimum of three "Satisfactory" declaration for the course completion

In laboratory courses (having only practical (*P*) component), the CCA will be based on students attendance (50%); collection of plant material (25%) and hands on Practical, records, etc. (25%)

For QUIZ (2 quizzes per semester), 25 marks per Quiz and total of 50 marks, 45 minutes duration for each quiz:

Types of question	Number of Questions	Marks per question	Total marks per type
1. Multiple choice	10	1	10
2. Fill in the blanks	10	1	10
3. Short answer (15 words)	5	1	05
Total	25		25

For the Term test and ESE:

Part A

Ten short type questions (Definitions, illustrations, functions, short explanations, etc; 25-50 words) for two marks each. 10 × 2= 20 marks; two questions from each Unit; no choice in this part

Part B

Five short answer (250 words) type questions for four marks each. 5 × 4 = 20 marks; one question from each Unit with internal choice

Part C

Five questions of long/explanatory answer (500 words) type, one drawn from each Unit; student need to answer any three; ten marks each; 3 × 10 = 30 marks

20+20+30 = 70 marks

Qualifying for Next semester

1. **A student acquiring minimum of 40% in total of the CCA is eligible to join next semester**.
2. A student who does not pass the examination (CCA+ESE) in any course(s) (or due to some reason as he/she not able to appear in the ESE, other conditions being fulfilled, and so is considered as 'Fail'), shall be permitted to appear in such failed course(s) in the subsequent ESE to be held in the following October / November or April / May, or when the course is offered next, as the case may be.
3. A student who fails in one or more papers in a semester shall get three more chances to complete the same; if he/she fails to complete the same within the prescribed time, i.e. three additional chances for each paper; the student is ineligible for the Postgraduate degree in the Subject in which he/she is admitted, for additional chances examination fee shall be on additive basis.

Improvement Option:

Every student shall have the opportunity to improve Credit thorough University Examination only. Improvement opportunity for each paper is only with two additional chances; improvement examination fee shall be on additive basis; the Credit obtained in improvement examination shall be final. There shall be no improvement opportunity in Practical examinations**.**

Result Declaration:

The ESE (End Semester Examination/University Examination) results shall be declared within twenty days of the last examination. The Theory/ Practical Classes of even semesters shall begin from the next day of ESE; whereas odd semester classes shall commence after summer vacation.

Students failed in CCA

Any student declared "Not Eligible" by the department based on CCA in semester I, II, III or IV and accordingly did not appear in ESE; can be readmitted as an additional student in that semester in the following year only. Such student need to deposit the annual fee as prescribed for that academic year

ADMISSION

The minimum qualification for admission to M.Sc. Course is B.Sc. (10+2+3) degree with Mathematics as a major subject. The details of eligibility conditions and admission procedure are given in the admission form. The admission will be done on the basis of merit calculated by the aggregate marks obtained at the B.Sc. leveland marks of Mathematics in B. Sc. Part I, II, III. Reservation of Scheduled Caste/Scheduled Tribes/Disabled/OBC/SBC will be as per Government rules. The candidates are required to attend minimum of a 75% of classes in both theory and practical.

TEACHING AND EXAMINATION SCHEME

Per Semester

Course	Periods/Week	Examination hours	CCA	ESE	Total
Theory Papers					
Course - I	6	3	30	70	100
Course - II	6	3	30	70	100
Course - III	6	3	30	70	100
Course – IV	6	3	30	70	100
Course – V	6	3	30	70	100

Students are required to pass in each theory papers in every semester.

Skill Courses are to be passed (with satisfactory grade) in each Semester (Odd Semester from Department and Even Semester from outside Department).

MSC MATHEMATICS I SEMESTER

Semester I							
Course- 1	MSMT-111	Algebra – I	6-0-0	6	30	70	100
Course- 2	MSMT-112	Advanced Real Analysis	6-0-0	6	30	70	100
Course- 3	MSMT-113	Differential Equations	6-0-0	6	30	70	100
Course- 4	MSMT-114	Special Functions	6-0-0	6	30	70	100
Course- 5	MSMT-115	Analytical Dynamics and Numerical Analysis- I	6-0-0	6	30	70	100
Skill Course I*	As per the list		2-0-2				
Total				30	150	350	500

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

MSMT-111: ALGEBRA-I	
UNIT - 1	Groups: Law of isomorphism. Direct products of groups. Theorems related to composition series. Jordan-Holder theorem
UNIT - 2	Groups :Definition of P-Group H-Conjugate Cauchy's theorems for finite Abelian and finite group. Sylow's theorems for abelian groups, solvable groups
UNIT - 3	Rings and Fields of Extension: Theorems on endomorphism of an abelian group. Direct product of rings. Polynomials rings, Factorisation in integral domain
UNIT - 4	Rings and Fields of Extension : Theorems related to finite and infinite extension of field. Minimal, Polynomials, Splitting field. Theorems on roots and coefficients of polynomial separable and inseparable extensions
UNIT - 5	Canonical Forms: Jordan Matrix, Jordan canonical form, Some decomposition theorems. Jordan normal forms. Definition and examples of linear algebra. Linear transformations

BOOKS RECOMMENDED

1. Surjeet Singh and Qazi Zammeruddin: Modern Algebra
2. Aggarwal, R.S.: Modern Algebra
3. Shanti Narain: Abstract Algebra; S. Chand & Co., New Delhi
4. Raisinghania, N.D. : Modern Algebra
5. Kofman, Kunj, Linear Algebra

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

MSMT-112: ADVANCED REAL ANALYSIS	
UNIT - 1	Real Sequences and convergence: Definition, limit point, bounds and properties of real sequences. Limit inferior and limit supirior of sequences. Bolzano – Weierstrars theorem for sequences, convergent and non-convergent sequences

UNIT - 2	Cauchy's general principle of convergence. Cauchy sequence, various theorems on limit of sequences. Monotonic sequence and its convergence
UNIT - 3	Cantor's set, Continuity and Discontinuity of functions of two and more variables, types of discontinuity. Jacobians
UNIT - 4	Uniform Convergence of sequences and series of functions. Various tests for uniform convergence. Weierstrass's M – Test
UNIT - 5	Uniform convergence and continuity. Uniform convergence and integration. Uniform convergence and differentiation

SUGGESTED READINGS
1. Shanti Narayan: Mathematical Analysis;S. Chand & Co., New Delhi. 2. Royden, H.L.: Real Analysis;MacMillan Publishing Co., New York 3. H.K. Pathak: Real Analysis; Shiksha Sahitya Prakashan; Meerut. 4. Malik, S.C. and Arora, S.: Mathematical Analysis. New Age India Int. (P) Ltd., New Delhi.

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

MSMT-113: DIFFERENTIAL EQUATIONS	
UNIT - 1	Non-linear ordinary differential equations of particular forms. Riccati's equation –General solution and the solution when one, two or three particular solutions are known
UNIT - 2	Classification of linear partial differential equation of second order, Canonical forms.
UNIT - 3	Solutions of Laplace, Wave and Heat conduction equations, Fourier series with application to simple boundary value problems on wave and heat conduction equations
UNIT - 4	Linear homogeneous boundary value problem, Eigen values and eigen functions, Sturm-Liouville boundary value problems, Lagrange's identity, properties of eigen functions, Periodic functions
UNIT - 5	Non-homogeneous boundary value problems, Non-homogeneous Sturm-Liouville boundary value problems (method of eigen function expansion)

SUGGESTED READINGS
1. Chaturvedi, J.C. and Ray, M.: Differential Equations; Ram nath Kedar Nath & Co. Agra. 2. Bansal, J.L. and Dharmi, H.S.: Differential Equations Vol. II, An Elementary Treatise Differential 3. Equations; Jaipur Publishing House, Jaipur 4. Arnold, V.I.: Ordinary Differential Equations, MIT Press, Cambridge, 1981.

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

MSMT-114: SPECIAL FUNCTIONS	
UNIT - 1	Hypergeometric functions: Definition of the Hypergeometric series and function. Properties of hypergeometric functions. Integral formula for hypergeometric series, Linear transformations
UNIT - 2	Contiguous function relations. Linear relations between the solutions of hypergeometric differential equation. Kummer's confluent hypergeometric function
UNIT - 3	Elementary properties of generalized hypergeometric function ${}_pF_q$.
UNIT - 4	Legendre Polynomials : Legendre's differential equation and its series solution, Generating Function of Legendre's polynomials $P_n(x)$, Orthogonality, Laplace's First and Second Integral for $P_n(x)$, Rodrignue's formula, Recurrence Relations
UNIT - 5	Bessel's equation and its solution; Bessel function of the first kind, Generating function for $J_n(x)$, Recurrence relations, Integral representations for $J_n(x)$, Addition formula for the Bessel functions

SUGGESTED READINGS

1. Rainville, E.D.: Special Functions, Macmillan and Co., New York 1960.
2. Sneddon, I.N.: Special Functions of Mathematical Physics and Chemistry,Oliver and Byod, 1961.
3. Watson, G.N.: A Treatise on the Theory of Bessel Functions, Cambridge University Press, 1931
4. Labedye, N.N.: Special Functions and their Applications, Dover, 1972.
5. Saxena, R.K. and Gokhroo, D.C.; Special Functions, Jaipur Publishing House

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

MSMT-115: ANALYTICAL DYNAMICS AND NUMERICAL ANALYSIS I	
UNIT - 1	D'Alembert's Principal, General equations of motion, the motion of the centre of inertia, motion relative to the centre of inertia, the moment of effective forces about a fixed axis of rotation, the moment of a moment about the axis of rotation, the kinetic energy of a rotating body about a fixed-line, equation of motion of a body about the axis of rotation, Principal of Energy and work
UNIT - 2	The Compound Pendulum: time of a complete oscillation of a compound pendulum, simple equivalent pendulum, centre of suspension and centre of oscillation, minimum time of oscillation of a compound pendulum. The conservation law of Linear and Angular Momentum under Finite and Impulsive Forces, Kinetic Energy as a Sum of Kinetic Energy due to Translation and Rotation
UNIT - 3	Calculus of variations: - linear functional, minimal functional theorem, a general variation of a functional equation, another form of Euler-Lagrange equation, functional dependent on higher-order derivatives and several dependent variables
UNIT - 4	Various fundamental problems viz.- Shortest Distance, Shortest Time, Minimum Surface of Revolution and Isoperimetric Problem. Rayleigh-Ritz Method for Boundary Value Problem

UNIT - 5	Numerical solution of the ordinary differential equation: - Euler method, modified Euler method Taylor series, Picard method Runge-Kutta method Milne method

SUGGESTED READINGS

1. Loney, S.L.: An Elementary Treatise on the Dynamics of a Particle and Rigid Bodies, Cambridge University Press.
2. Ray,M.: Dynamics of Rigid Bodies, Students Friends and Co.
3. Gupta, P.P.: Rigid Bodies analytic Dynamics I, II, Krishna prakashan media (P)Ltd.
4. Freeman, H.: Finite Differences and Mathematics for Actuarial Students
5. Richardson,H.C.: Calculus of Finite Differences
6. Elsgotts, L.E.: Calculus of Variations
7. Bansal, J.L.: Dynamics of a Rigid Body, Jaipur Publishing Co

MSC MATHEMATICS II SEMESTER

Semester II							
Course- 6	MSMT-211	Algebra - II	6-0-0	6	30	70	100
Course- 7	MSMT-212	Measure Theory and Integration	6-0-0	6	30	70	100
Course- 8	MSMT-213	Hydrodynamics	6-0-0	6	30	70	100
Course- 9	MSMT-214	Classical Polynomials and Integral Transforms	6-0-0	6	30	70	100
Course- 10	MSMT-215	Analytical Dynamics and Numerical Analysis- II	6-0-0	6	30	70	100
Skill course II*	As per the list		2-0-2				
Total				30	150	350	500

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

MSMT-211: ALGEBRA-II	
UNIT - 1	Kernel and range space of a linear mapping, Rank and nullity, Singular and non-singular mapping or transformations. Invariance and Reducibility
UNIT - 2	Galois Theory, Monomorphism and their Linear Independence. Arten theorem on automorphism, Normal extensions and Fundamental theorem of Galois theory
UNIT - 3	Radical extensions and solvability by Radicals. Constructions by Ruler and Compass Ring with Chain conditions. Hilbert's Bases theorem. Artinian rings
UNIT - 4	**:** Linear transformations and system of linear equations. Quotient transformations. Inner product. Inner product spaces. Algebra of linear operators
UNIT - 5	Matrix representation of linear operators. Dual spaces. Unitary and normal operators. Matrices of linear transformations with respect of different bases

BOOKS RECOMMENDED

1. Surjeet Singh and Qazi Zammeruddin: Modern Algebra
2. Aggarwal, R.S.: Modern Algebra
3. Shanti Narain: Abstract Algebra; S. Chand & Co., New Delhi
4. Raisinghania, N.D. : Modern Algebra
5. Kofman, Kunj, Linear Algebra

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

MSMT-212: MEASURE THEORY AND INTEGRATION	
UNIT - 1	Definitions of measure, Lebesgue outer measure, Measure of sets, Non-measurable sets, Exterior and interior measure of sets and their simple properties, Measurable functions
UNIT - 2	Definition of Lebesgue Integral of a bounded measurable function, Comparison of Lebesgue and Riemann Integral. Lebesgue theorem of bounded convergence, Egoroff's theorem

UNIT - 3	Lebesgue Integral of unbounded function, Elementary properties of Integrals, Definition and simple properties of function of bounded variation
UNIT - 4	Absolutely continuous functions. The Lebesgue set, Integration by parts, The second mean value theorem, The Lebesgue class L^p, Schwarz's inequality
UNIT - 5	Holder's inequality, Holder's inequality for sums, Minkowski's inequality. Integration of a function of L^p, mean convergence for the function of the class L^p

BOOKS RECOMMENDED
1. Malik, S.C. and Arora, S.: Mathematical Analysis. New Age India Int. (P) Ltd., New Delhi.
2. Jain, P.K. and Gupta, V.P. Lebsegue Measure and Integration, New Age Int. (P) Ltd., New Delhi

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

MSMT-213: HYDRODYNAMICS	
UNIT - 1	Kinematics of fluids in motion, Lagrange's and Euler's methods, Stream lines and path lines, Velocity potential. Vorticity vector, Equation of continuity in orthogonal curvilinear, Cartesian, spherical polar and cylindrical coordinates, Boundary surface condition
UNIT - 2	Euler's equations of motion, Bernoulli's equation, Bernoulli's theorem. Impulsive motion
UNIT - 3	Motion in two-dimensions, Stream function, Complex potential. Sources, Sinks, Doublets, Images in two-dimensions. Milne Thomson circle theorem
UNIT - 4	Viscocity, Newton's law of viscocity, Navier-stoke's, equations of motion for viscous incompressible flow **,**Vorticity and Circulation
UNIT - 5	Dynamical similarity, Dimensional analysis. P-Buckimgham theorem. Physical importance of non-dimensional parameters. Renold's number, Prandtl number. Mach number, Froude Number, Nusselt number

BOOKS RECOMMENDED
1. Bansi Lal: Theoretical Hydrodynamics; jaipur Publishing House, Jaipur.
2. Milne-Thomson: Theoretical Hydrodynamics
3. Ray, M.: A Text Book of Fluid Dynamics; S. Chand & Co., New Delhi.
4. Chorlton, F.: Text Book of Fluid Dynamics
5. Bansal, J.L. : Viscous Fluid Dynamics; jaipur Publishing House, Jaipur

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

MSMT-214: CLASSICAL POLYNOMIALS AND INTEGRAL TRANSFORMS	
UNIT - 1	Generating function and other properties associated with Hermite Polynomials
UNIT - 2	Generating function and other properties associated with Laguerre Polynomials
UNIT - 3	Fourier transforms and its properties. Fourier sine and consine transforms. Convolution theorem for fourier transforms. Parseval's identity for fourier transforms
UNIT - 4	Mellin transform and their properties
UNIT - 5	Elementary properties of Hankel transforms, relation between Hankels and laplace transform. Parseval's theorem for Hankel transforms

BOOKS RECOMMENDED

1. Sneddon, I.N.: Use of Integral Transforms; Tata MacGraw-Hill, New Delhi.
2. Rainville, E.D.: Special Functions, Macmillan and Co., New York 1960.
3. Sneddon, I.N.: Special Functions of Mathematical Physics and Chemistry,Oliver and Byod, 1961.
4. Watson, G.N.: A Treatise on the Theory of Bessel Functions, Cambridge University Press, 1931
5. Labedye, N.N.: Special Functions and their Applications, Dover, 1972.
6. Saxena, R.K. and Gokhroo, D.C.; Special Functions, Jaipur Publishing House

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

MSMT-215: ANALYTICAL DYNAMICS AND NUMERICAL ANALYSIS-II	
UNIT - 1	Generalized and Principal coordinates, Lagrange's equations for finite and impulsive forces, small oscillations
UNIT - 2	Motion in three dimensions. Euler's dynamical and geometrical equations for the motion of a rigid body and problems related to no external forces. Deduction of Euler equation from Lagrange's equation.
UNIT - 3	Hamilton's canonical equations of motion. Hamilton's principle and principle of least action. Deduction of Euler equation from Hamilton's canonical equations
UNIT - 4	Canonical Transformations, Poisson's brackets and their properties. General equations of motion in terms of Poisson brackets. Lagrange's brackets and their properties
UNIT - 5	Finite Difference Scheme for Partial Difference Equation: - Difference Quotients, SFPF and DFPF. Iteration Method, Jacobi Method, Gauss-Seidel Method, Successive over Relaxation Method, Bender-Schmidt Method

BOOKS RECOMMENDED

1. Loney, S.L.: An Elementary Treatise on the Dynamics of a Particle and Rigid Bodies, Cambridge University Press.
2. Ray,M.: Dynamics of Rigid Bodies, Students Friends and Co.

3. Gupta, P.P.: Rigid Bodies analytic Dynamics I, II, Krishna prakashan media (P)Ltd.
4. Soarborough, James, B.: Numerical Analysis
5. Freeman, H.: Finite Differences and Mathematics for Actuarial Students
6. Richardson,H.C.: Calculus of Finite Differences
7. Elsgotts, L.E.: Calculus of Variations
8. Bansal, J.L.: Dynamics of a Rigid Body, Jaipur Publishing Co

MSC MATHEMATICS III SEMESTER

Semester III							
Course- 11	MSMT-311	Complex Analysis	6-0-0	6	30	70	100
Course- 12	MSMT-312	Tensor Analysis	6-0-0	6	30	70	100
Course- 13	MSMT-313	Functional Analysis – I	6-0-0	6	30	70	100
Course- 14	MSMT-314	Any one from Elective Courses from **Group – A****	6-0-0	6	30	70	100
Course- 15	MSMT-315	Any one from Elective Courses from **Group – B****	6-0-0	6	30	70	100
Skill course – III*	As per the list		2-0-2				
Total				30	150	350	500

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

MSMT-311: COMPLEX ANALYSIS	
UNIT - 1	Conformal transformations, bilinear transformation, cross ratios and some special transformations. Taylor's and Laurent's theorem
UNIT - 2	Poles and Singularities. Theory of residues. Contour integration
UNIT - 3	Principle of maximum and minimum modulus; principle of argument, Schwarz's lemma, Rouche's theorem, Fundamental theorem of Algebra
UNIT - 4	Meromorphic function, Mittag-Leffler's theorem, Analytic continuation, definition and illustrations
UNIT - 5	Harmonic Functions: Definition, Basic Properties, Maximum Principle (First Version), and (second Version). Harnack's inequqality, subharmonic and superharmonic functions

BOOKS RECOMMENDED

1. Shanti Narayan: Theory of Functions of Complex Variable; S. Chand & Co., New Delhi.
2. Mathews, J.H.: Howell, R.W. Complex analysis, Jones and Bartlet, India (2011).
3. Chouhan, J.P. Complex Analysis, (2006), Kedar Nath Ram Nath.
4. H.K. Pathak: Complex Analysis; Shiksha Sahitya, Prakashan, Meerut (2011).

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

MSMT-312: TENSOR ANALYSIS	
UNIT - 1	Notations and definitions of contravariant and covariant tensors of first and second order. Mixed tensors, higher order tensors. Contraction and Quotient law for tensors. Symmetric and skew symmetric tensors
UNIT - 2	Metric [Fundamental] tensor, conjugate metric tensors. Definitions and properties of first and second kind of Christoffel's symbols. Laws of transformation of Christoffel's symbols

UNIT - 3	Covariant derivatives of contravariant and covariant tensors of first and second orders. Laws of covariant differentiation. Ricci's Theorem
UNIT - 4	Definition and properties of Riemann-Christoffel's tensor. Definition and properties of covariant curvature tensor
UNIT - 5	Contraction of Riemann-Christoffel Tensor-Ricci tensor

BOOKS RECOMMENDED
1. Bansal, J.L.: Tensor Analysis, Jaipur Publishing House, (2004)

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

MSMT-313: FUNCTIONAL ANALYSIS -I	
UNIT - 1	Metric Spaces: Definitions and examples of the metric space, Open and Closed sets, Neighbourhood, Interior, Limit points and Isolated points, Subspace of a metric space, Product spaces. Completeness: Convergent sequence, Complete spaces,Dense sets and Separable spaces, Baire's Category theorem
UNIT - 2	Compactness: Compact spaces and sets, Sequential compactness, Heine-Borel theorem, Equivalence of compactness and sequential compactness, Continuous mapping
UNIT - 3	Normed spaces and their Properties: Banach space, Quotient space of a Banach space, Finite dimensional normed spaces and subspaces. Linear Operators, Linear operators and functionals on finite dimensional spaces. Normed spaces of operators
UNIT - 4	Dual space : Space B(x,y), completeness theorem. Fundamental theorem for normed spaces and Banach space: Zorn's lemma, Hahn-Banach theorem, Hahn-Banach theorem for complex vector spaces and normed spaces
UNIT - 5	Reflexive operator, Definitions of strong convergence and weak convergence, Lemma for weak convergence, Lemma for weak convergence for the space l^p , Strong and weak convergence theorem, Open mapping theorem, Closed graph theorem.s

BOOKS RECOMMENDED
1. Kreyszig, E. Introductory Functional Analysis with Applications, John Wiley & Sons (1978).
2. Somasundaram, D.A. First Course in Functional Analysis, Narosa Publishing House, Delhi (2006).
3. Taylor, A.E. Introduction to Functional; Analysis, John Wiley & Sons (1958).
4. Choudhary, B. and Nanda, S. Functional Analysis with Applications, Wiley Eastern Limited, Delhi (1989).
5. Rudin, W. Functional Analysis, Tata McGraw-Hill Publ. Co. Ltd., Delhi (1977).
6. Jain, P.K. and Ahmad, Khalil, Metric Spaces, Narosa Publishing House (1996).
7. Copson, E.T. Metric Spaces, Universal Book Stal, Delhi (1989).
8. Berberian, S. Introduction to Hilbert Space, Oxford University Press, Oxford (1961).
9. Edwards, R.E. Functional Analysis Theory and Applications, Dover Publications, Inc. (1995)

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

Elective Papers Group – A (Any One) **MSMT-314(a): Magneto Fluid Dynamics - I**	
UNIT - 1	Definition of MFD and MFD Phenomenon. Charge conservation equation, Maxwell's equations, constitutive equations, Generalized Ohm's law. Equation of State, Equation of continuity, Equations of motion, Equation of energy
UNIT - 2	MFD approximations, Magnetic field equation, Magnetic Reynolds number, Alfven's theorem, Magnetic energy, Electromagnetic stresses, force-free magnetic fields
UNIT - 3	Basic equations for MHD flow, MHD boundary conditions, MHD flow between parallel plates. Velocity distribution in Hartmann flow and Hydromagnetic Couette flow
UNIT - 4	MHD flow in a tube of rectangular cross-section, MHD pipe flow
UNIT - 5	MHD flow in an annular channel, MHD flow between two rotating coaxial cylinders, MHD boundary layer approximations.

BOOKS RECOMMENDED

1. Bansal, J.L.: Magnetofluiddynamics of Viscous fluids, Jaipur Publishing House, Jaipur, India
2. Farraro, V.C.A. and Plumpton, C.: Magnetofluidmecbanics Jeffereys, A.; Magnetohydrodynamics
3. Cowing, T.G.: Magnetohydrodynamics
4. Cramer, K.R. and Pai S.I.: Magnetofluiddynamics for Engineers and Physicists, Scripta Publishing Company, Washington, D.C., 1973.
5. Pai, S.I.: Magneto Geodynamics & Plasma Dynamics, Springer-Verlag, New York, 1962.
6. Shereliff, J.A.: Magnetohydrodynamics, Pergamon Press, London, 1965

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

Elective Papers Group – A (Any One) **MSMT-314(b): LINEAR OPERATORS IN HILBERT SPACE - I**	
UNIT - 1	Linear spaces. The scalar product, Hilbert space, Linear manifolds and subspaces. The distance from a point to a subspace. Projection of a vector on a subspace
UNIT - 2	Orthogonalization of a sequence of vectors, Complete orthonormal systems. The space L^2 and complete orthonormal system in $\boldsymbol{L}_1^2$.
UNIT - 3	Linear functionals. The theories of F Riesz. A criterion for the closure in H of given system of vectors. A Lemma concerning convex functionals, Bounded linear operators
UNIT - 4	Bilinear functions. The general form of a Bilinear functional adjoint operators. Weak convergence in H weak compactness
UNIT - 5	A criterion for the boundedness of an operator, Linear operators in a separable space. Complete continuous operators. A criterion for complete continuity of an operator. Sequence of bounded Linear Operators

BOOKS RECOMMENDED
1. Akhiezer, N.I. and Glazman, I.M.: Theory of Linear Operation in Hilberts Space. 2. Translated from the Russian by Merlyind Nestell, Vingar Pub. Co., New York

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

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Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

Elective Papers Group – A (Any One) MSMT-314(c): LAMINAR VISCOUS FLOW THEORY - I	
UNIT - 1	Fluid, Continuum hypothesis. Constitutive equation for Newtonian fluids, Navier-stoke's equations for viscous compressible flow, equation of energy for compresable flow Vorticity and Circulation
UNIT - 2	Velocity and Temperature distributions in plane Couette flow, Plane Poissuille flow and Haigen-Poissuille flow in a circular pipe
UNIT - 3	Flow in tubes of uniform cross section , flow between two concentric rotating cylinder stagnation in two dimantional flow
UNIT - 4	Flow due to a plane wall suddenly set in motion (Stoke's first problem). Flow due to an oscillating plane wall (Stoke's second problem), variable viscocity plane Couette flow and Plane Poissuille flow
UNIT - 5	Theory of very slow motion: Stoke's equation of very slow motion. Stoke's flow past a sphere, stoke's stream function. Oseen equations. Lubrication theory

BOOKS RECOMMENDED
1. Schliching H.: Boundary Layer Theory, McGraw Hill. 2. Pai, S.I.: Viscous Flow Theory, Vol.I, Laminar Flow, D.Van Nostrand Company, New York, 1956. 3. Bamal, J.L.: Viscous Fluid Dynamics, Oxford and IBH, 2004. 4. Charlton, P.: Text Book on Fluid Dynamics, CBS Publications, Delhi, 1985. 5. Rathy, R.K.: An Introduction to fluid dynamics Oxford & IBH Publishing Company, New Delhi, 1976

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

Elective Papers Group – A (Any One) MSMT-314(d): PROBABILITY AND STATISTICAL DISTRIBUTIONS - I (Only for Non-Statistics students of B.Sc. Final)	
UNIT - 1	Probability, Random Variables & their probability distribution: Probability: Random Experiment, Statistical Regularity, Algebra of events. Classical, relative frequency and axiomatic approaches of probability. Additive law and Bool's inequalities. Conditional probability. Stochastic independence of events. Multiplicative law of probability and Baye's Theorem

UNIT - 2	Random Variable (R.V.): Discrete RV. Probability mass function (p.m.f.). continuous r.v. probability density functions (p.d.f). Cumulative distribution function (c.d.f). and its properties. Two dimensional Random Variable. Joint, marginal and conditional, p.m.f., p.d.f. and c.d.f. Independence of random variable
UNIT - 3	Expectation of Random Variable and function of r.v. Theorems on Expectation and inequalities, Moments: Factorial moments, Moments about a point A, Raw moments and Central moments. Measurers of Central tendency, Measures of Dispersion, Measures of Skewness and Kurtosis
UNIT - 4	Moment generating function (m.g.f.), Cumalant generating function (c.g.f.) and characteristic function (c.f.) of random variables. Product moments and Joint m.g.f. of random variables. Convergence of sequence of random variables; Convergence in law (or in distribution), convergence in probability. Convergence in rth moment
UNIT - 5	Discrete Distribution. Discrete Uniform distribution. Bernoulli distribution Binomial distribution. Hypergeometric distribution

BOOKS RECOMMENDED
1. Mathematical Statistics By Parimal Mukhopadhyay (Books and Allied (P.) Ltd.,
2. An Introduction to Probability and Statistics By Vijay K. Rophtgi & A.K. Mod. Ehsanes Saleh.
3. Fundamental of Mathematical Statistics By S.C.Gupta and V.K. Kapoor (Sultan Chand & Sons).

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

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Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

Elective Papers Group – B (Any One) **MSMT-315(a): GENERALIZED FUNCTIONS - I**	
UNIT - 1	Definition and simple properties of generalized functions, Functional and generalized functions
UNIT - 2	Differentiation and integration of generalized functions, Regularization of functions of algebraic singularities
UNIT - 3	Associated functions, Convolution of generalized functions, Elementary solutions of differential equations with constant coefficient
UNIT - 4	Fourier Transforms of generalized functions. Fourier transform of test function, Fourier transforms of generalized functions of one and several variables. Fourier transform and differential equations
UNIT - 5	Particular type of generalized functions: Generalized functions concentrated on smooth monifolds of lower dimension. Generalized functions associated with Quadratic form. Homogeneous functions Arbitrary functions raised to a power

BOOKS RECOMMENDED
1. Gellifand, I.M. and Shilvo, G.C.: Generalized functions, Vol. I. Acad. Press. 1964.
2. Fredman, A.: Generalized Functions and Partial Differential Equations,
3. Prentice Hall. Inc., Englewood Cliffs, N.J., U.S.A., 1963.

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

Elective Papers Group – B (Any One) **MSMT-315(b): FUNDAMENTALS OF OPERATIONS RESEARCH - I**	
UNIT - 1	Basic concepts of probability. Conditional probability, Bayes' theorem; Basic concepts of Poisson, exponential distributions
UNIT - 2	Definition, scope and objectives of O.R., Different types of O.R. Models, basic ideas of convex sets. Linear programming problems-Simplex Method, two phase method
UNIT - 3	Duality of L.P.P., Transportation and assignment problems
UNIT - 4	Theory of games: Competitive strategies, minimax and maximin criteria, two person zero-sum games with and without saddle point, dominance, fundamental theorem of game
UNIT - 5	Inventories: Single item deterministic inventory models with finite and infinite rates of replenishment

BOOKS RECOMMENDED

1. Kanti Swaroop, Gupta, Man Mohan: Operations Research, Sultan Chand and Sons.
2. Goel and Mittal: Operations Research, Pragati Prakashan
3. Mittal, K.V.: Optimizadon Methods in O.R. and S. Analysis
4. Sharma, S.D.: Operations Research
5. Loomba, N.P.: Linear Programming
6. Satty, T.L.: Mathematical Methods of Operations Research

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

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Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

Elective Papers Group – B (Any One) **MSMT-315(c): INTEGRAL EQUATIONS - I**	
UNIT - 1	General concepts of integral equation. Linear integral equations of the first and second kind of Fredholm and Volterra types. Types of kernels, Definition of Eigen values and eigen function, Solution of an integral equation, Converstion of differential equations to integral equations: IVP and BVP., Solution of fredholm and Volterra Integral equation of second kind by successive substitution and successive approximations
UNIT - 2	Homogeneous Fredholm integral equation of second kind with separable (or Degenerate) kernel, Eigen values and Eigen functions
UNIT - 3	Hilbert – Schmidt theory by symmetric kernels. Riesz – Fischer theorem. Hilbert – Schmidt theorem. Hilbert's theorem
UNIT - 4	Schmidt's solution of the non-homogeneous fredholm integral equation of second kind
UNIT - 5	Solution of integral equation by Resolvent Kernel. Singular Integral equation. Solution of Abel's integral equation. General form of Abel Singular integral equation. Weakly Singular Kernel

BOOKS RECOMMENDED
1. W.V.Lovaitt: Linear Integral Equation, Dover Publications, 1950. 2. Krasnov, Kiselev and MakrankoL Problem and Exercises in Integral Equations, Translated by G. Yankovsky, Mir Publishers, Moscow, 1971. 3. Mikhlim, S.G.: Integral Equations, Pergamon, Oxford, 1957 4. Triconi, F.D.: Integral Equations, Interscience, New York, 1957. 5. Pundir, S.K. and Pundir, R. Integral equations and Boundary Value Problems, Pragati Prakashan, Meerut (U.P.) 6. Chandramouli, A.B.: Integral Equations with Boundary Value Problems, Shiksha Sahitya Prakashan, Meerut (U.P.)

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

Elective Papers Group – B (Any One) MSMT-315(d): ADVANCED NUMERICAL ANALYSIS - I	
UNIT - 1	Solution of Algebraic and Transcendental Equations: Newton-Raphson method for real multiple roots, Newton-Raphson method for complex roots and Newton-Raphson method for system of non-linear equations
UNIT - 2	Synthetic Division, Birge-Vieta, Bairstow and Graefre's root squaring methods for Numerical solution of polynomial equations
UNIT - 3	Solution of simultaneous Linear Equations: Direct methods: Gauss-elimination, Gauss-Jordan, Cholesky and Partition method. Iterative Methods: Jacobi iteration, Gauss-seidel iteration and Successive Relaxation method
UNIT - 4	Eigen value Problems: power method, Jacobi Method and Givin's Method for finding Eigen values of a matrix
UNIT - 5	Curve fitting and Function Approximation: Least square Method, Fitting a straight line, Second Degree Polynomials, Exponential Curves and Logarithmic Curves.

BOOKS RECOMMENDED
1. Jain, M.K.,Iyenger, SRK, Jain R.K.: Numerical Methods for Scientists & Engineering Computations, Wiley Eastern Ltd., 2. Shastry, S.S.: Introductory Methods of Numerical Analysis, Prentice Hall India Pvt., Ltd., 3. Grewal, B.S. : Numerical Methods in Engineering & Science, Khanna Publishers. 4. Collatz, L.: Numerical Solution of Differential Equations, Tata McGraw-Hill. 5. D.S. Chouhan: Numerical Methods, JPH

MSC MATHEMATICS IV SEMESTER

Semester IV							
Course- 16	MSMT-411	Topology	6-0-0	6	30	70	100
Course- 17	MSMT-412	Differential Geometry	6-0-0	6	30	70	100
Course- 18	MSMT-413	Functional Analysis – II	6-0-0	6	30	70	100
Course- 19	MSMT-414	Any one from Elective Courses from **Group – A****	6-0-0	6	30	70	100
Course- 20	MSMT-415	Any one from Elective Courses from **Group – B****	6-0-0	6	30	70	100
Skill course – IV*	As per the list		2-0-2				
Total				30	150	350	500

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks.

MSMT-411: TOPOLOGY	
UNIT - 1	Definition of topological spaces by using open sets, Characterization in terms of closed sets. Interior, closure and neighborhood operators
UNIT - 2	Frontier of a set, Sub-space. Bases and sub-bases, dense subsets. Connected spaces
UNIT - 3	Continuous functions, closed and open functions. Homomorphism, First and Second axioms of countability
UNIT - 4	Separable spaces. Lindeloff spaces. T_0, T_1 and T_2 spaces. Regular and normal spaces
UNIT - 5	Compact spaces: Compactness, properties of Compact spaces, locally Compact spaces, one point compactification

BOOKS RECOMMENDED

1. B.D. Gupta: Topology; Kedar Nath Ram Nath; Delhi; Meerut.
2. Colin Adams and Robert Franzosa: Introduction to Topology; Dorling Kindersley India Pvt. Ltd., Pearson Prentice Hall (2009), Delhi.
3. K.P. Gupta: Topology: Pragati Prakashan, Meerut.

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

MSMT-412: DIFFERENTIAL GEOMETRY	
UNIT - 1	Curves in Space: Definition of unit tangent vector, tangent line, Normal line and Normal plane. Contact of a curve and a surface. Equation of osculating plane. Fundamental unit vectors, equations of fundamental planes
UNIT - 2	Curvature, Torsion and skew curvature vectors. Serret-Frenet formulae and their applications. Definition and properties of the osculating circle and osculating spheres. Bertrand curves and their properties. Involute and evolute of space curves

UNIT - 3	Envelope of family of surfaces. Ruled surfaces: Definition and properties of developable and skew surfaces. Parametric representation of a surface. First and Second fundamental forms and magnitudes of various surfaces
UNIT - 4	Definition and Differential equation of lines of curvature (Excluding theorms). Definition and equation of curvature and torsion of asymptotic lines. Beltrami-Enneper Theorem
UNIT - 5	Fundamental equations of Surface Theory: Gauss equations, Gauss Characteristic equations, Weingarten equations and Mainardi-Codazai equations

BOOKS RECOMMENDED
1. Bansal, J.I. and Sharma, P.R.: Differential Geometry: Jaipur Publishing House (2004).
2. Thorpe, J.A.: Introduction to Differential Geometry, Springer-verlag.
3. Slemberg, S.: Lectures on Differential Geometry, P.H.I. (1964).
4. Docarmo, M.: Differential Geometry of Curves and surfaces, P.H.I. (1976).
5. Gupta, P.P. and Malik, G.S.: Three Dimensional Differential Geometry, Pragati Prakashan, Meerut

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

MSMT-413: FUNCTIONAL ANALYSIS - II	
UNIT - 1	Convergence of sequences of operators and functional. Inner spaces: Hilbert spaces: Orthogonality, Euclidean space R^n , Unitary space C^n, Space L^2 [a,b]
UNIT - 2	Hilbert sequence space l^2 . Space l^p and space C [a,b], Properties of inner product spaces, Orthogonal sets and sequences, Representation of functional on Hilbert spaces, Hilbert adjoint operator
UNIT - 3	Spectral theory of linear Operators in Normed Spaces: Bounded self-adjoint linear operator, Definitions : Eigenvalues, Eigenvectors,Eigenspaces and Spectrum, Resolvent set of a matrix
UNIT - 4	Theorems: Eigenvalues of an operator,Adjoint operator, Closed spectrum theorem, Representation theorem. Hilbert adjoint operator.
UNIT - 5	Eigenvalue and Eigenvector Theorems, Norm theorem, Theorem on product of positive operators, monotone sequence, positive square root, Projection, Product of projection

BOOKS RECOMMENDED
1. Kreyszig, E. Introductory Functional Analysis with Applications, John Wiley & Sons (1978).
2. Somasundaram, D.A. First Course in Functional Analysis, Narosa Publishing House, Delhi (2006).
3. Taylor, A.E. Introduction to Functional; Analysis, John Wiley & Sons (1958).
4. Choudhary, B. and Nanda, S. Functional Analysis with Applications, Wiley Eastern Limited, Delhi (1989).
5. Rudin, W. Functional Analysis, Tata McGraw-Hill Publ. Co. Ltd., Delhi (1977).
6. Jain, P.K. and Ahmad, Khalil, Metric Spaces, Narosa Publishing House (1996).
7. Copson, E.T. Metric Spaces, Universal Book Stal, Delhi (1989).
8. Berberian, S. Introduction to Hilbert Space, Oxford University Press, Oxford (1961).
9. Edwards, R.E. Functional Analysis Theory and Applications, Dover Publications, Inc. (1995)

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

Elective Papers Group – A (Any One) **MSMT-414(a): MAGNETO FLUID DYNAMICS - II**	
UNIT - 1	Two dimensional MHD boundary layer equations for flow over a plane surface for fluids of large electrical conductivity. MHD boundary lawyer flow past a semi infinite rigid flat plate in an aligned and Transverse magnetic field. Two-dimensional thermal boundary layer equations for flow over a plane surface
UNIT - 2	MHD waves, waves in an infinite fluid of infinite electrical conductivity, Alfven waves. Reflection and Refraction of Alfven waves. MHD waves in a compressible fluid
UNIT - 3	MHD waves in the presence of dissipative effects. Hydromagnetic shock waves, stationary plane shock waves in the absence of a magnetic field
UNIT - 4	Plane hydromagnetic shock waves, plane shock waves advancing into a stationary gas. MFD Applications: MFD ejectors, MFD accelerators, MFD Lubrication, MFD thin Airfoil, MFD Power generation
UNIT - 5	Motion of a charged particle in uniform static electric and magnetic fields. Motion of a charged particle in crossed electric and magnetic fields. Magnetic moment, Particle drifts in an inhomogeneous magnetic field. Drifts produced by a field of force

BOOKS RECOMMENDED

1. Bansal, J.L.: Magnetofluiddynamics of Viscous fluids, Jaipur Publishing House, Jaipur, India
2. Farraro, V.C.A. and Plumpton, C.: Magnetofluidmecbanics Jeffereys, A.; Magnetohydrodynamics
3. Cowing, T.G.: Magnetohydrodynamics
4. Cramer, K.R. and Pai S.I.: Magnetofluiddynamics for Engineers and Physicists, Scripta Publishing Company, Washington, D.C., 1973.
5. Pai, S.I.: Magneto Geodynamics & Plasma Dynamics, Springer-Verlag, New York, 1962.
6. Shereliff, J.A.: Magnetohydrodynamics, Pergamon Press, London, 1965

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

Elective Papers Group – A (Any One) **MSMT-414(b): LINEAR OPERATORS IN HILBERT SPACE - II**	
UNIT - 1	Definition of a projection operator. Properties of projection operators. Operations involving projection operators, Monotone sequences of projection operators
UNIT - 2	The aperture of two linear manifolds. Unitary operators, Isometric operators. The Fourier-Plan-Cherel operator. Closed operators
UNIT - 3	The general definition of an adjoint operator. Eigen vectors. Invariant subspaces and reducibility of linear operators. Symmetric operators
UNIT - 4	The concept of the spectrum. The resolvent conjugation operators. The graph of an operator
UNIT - 5	Matrix representation of unbounded symmetric operators. The operation of multiplication by the independent variable

BOOKS RECOMMENDED
1. Akhiezer, N.I. and Glazman, I.M.: Theory of Linear Operation in Hilberts Space. 2. Translated from the Russian by Merlyind Nestell, Vingar Pub. Co., New York

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

Elective Papers Group – A (Any One) MSMT-414(c): LAMINAR VISCOUS FLOW THEORY - II	
UNIT - 1	Laminar Boundary layers.Two dimensional incompressible boundary layer equations. The boundary layer on a flat plate (Blasuis-Topfer-solution), boundary layer parameters
UNIT - 2	Similar Solutions of boundary layer equations. Wedge flow, Flow in a convergent channel. Flow in the wake of flat plate. Two dimensional Plane jet flow. Prandtl-Mises transformation and its application to plane jet flow
UNIT - 3	Boundary layer separation. Boundary layer on a symmetrically placed cylinder (Blasius series solution) Gortler new series method. Axially symmetrical boundary layer. Mangler's transformation.
UNIT - 4	Three dimensional boundary layers; boundary layer on yawed cylinder. Non-steady boundary layer formation (i) after impulsive start of motion (two dimensional case) and (ii) in accelerated motion
UNIT - 5	Thermal boundary layers in two dimensional incompressible flow, Crocco's integrals. Forced convection in a laminar boundary layer on a flat plate. Free convection from a heated vertical plate

BOOKS RECOMMENDED
1. Schliching H.: Boundary Layer Theory, McGraw Hill. 2. Pai, S.I.: Viscous Flow Theory, Vol.I, Laminar Flow, D.Van Nostrand Company, New York, 1956. 3. Bamal, J.L.: Viscous Fluid Dynamics, Oxford and IBH, 2004. 4. Charlton, P.: Text Book on Fluid Dynamics, CBS Publications, Delhi, 1985. 5. Rathy, R.K.: An Introduction to fluid dynamics Oxford & IBH Publishing Company, New Delhi, 1976

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

Elective Papers Group – A (Any One) MSMT-414(d): PROBABILITY AND STATISTICAL DISRIBUTIONIS-II (Only for Non-Statistics students of B.Sc. Final)	
UNIT - 1	Poisson distribution. Geometrical distribution. Negative Binomial Distribution,the Power series distribution. The properties and interrelation of these distribution

UNIT - 2	Continuous distributions: Continuous uniform distribution, exponential distribution, Gamma distribution, Beta I and II kind distributions, Cauchy distribution, Normal distribution and Double exponential distribution
UNIT - 3	Probability distribution of functions of random variables: Moment generating, cumulative distribution and transformation techniques to find distribution of function of random variables
UNIT - 4	Truncated distributions, Compound (or composite) distributions and Sampling distributions: Truncated distribution: Definition of Truncated distribution, Truncated Binomial, Poisson and Normal distributions. Compound distributions: Definition, practical situation and applications of compound distributions
UNIT - 5	Sampling distributions: Random sample, parameter and statistic, standard error, Sampling Distribution of sample mean $\bar{x}$ and variance s^2 from normal population. Chi-square, t and F distributions. Methods of estimation of parameters: Method of Maximum Likelihood, Method of Moments and Method of Least squares

BOOKS RECOMMENDED
1. Mathematical Statistics By Parimal Mukhopadhyay (Books and Allied (P.) Ltd., 2. An Introduction to Probability and Statistics By Vijay K. Rophtgi & A.K. Mod. Ehsanes Saleh. 3. Fundamental of Mathematical Statistics By S.C.Gupta and V.K. Kapoor (Sultan Chand & Sons)

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

Elective Papers Group – B (Any One) **MSMT-415(a): GENERALIZED FUNCTIONS - II**	
UNIT - 1	Elementary solutions of differential equations with constant coefficients
UNIT - 2	Fourier Transforms of generalized functions. Fourier transform of test function
UNIT - 3	Fourier transforms of generalized functions of several variables. Fourier transform and Differential Equations
UNIT - 4	Generalized functions concentrated on smooth monifolds of lower dimension. Generalized functions associated with Quadratic form
UNIT - 5	Generalized Homogeneous functions, Arbitrary functions raised to a power

BOOKS RECOMMENDED
1. Gellifand, I.M. and Shilvo, G.C.: Generalized functions, Vol. I. Acad. Press. 1964. 2. Fredman, A.: Generalized Functions and Partial Differential Equations, 3. Prentice Hall. Inc., Englewood Cliffs, N.J., U.S.A., 1963.

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

Elective Papers Group – B (Any One) **MSMT-415(b): FUNDAMENTALS OF OPERATIONS RESEARCH - II**	
UNIT - 1	Inventories: Economic lot-size model with known demand and its extension allowing backlogging of demand concept of price break, simple probabilistic models
UNIT - 2	Replacement problems: Replacement of item that deteriorate, replacement of items that fail completely
UNIT - 3	Replacement Problems: Group replacement policy, individual replacement policy, mortality tables, staffing problems
UNIT - 4	Queing theory-Ques with Poisson input and exponential service time, the queue length, waiting time and busy period in steady state case
UNIT - 5	Queing theory: Model with service in phase, multiserver queueing models

BOOKS RECOMMENDED

1. Kanti Swaroop, Gupta, Man Mohan: Operations Research, Sultan Chand and Sons.
2. Goel and Mittal: Operations Research, Pragati Prakashan
3. Mittal, K.V.: Optimizadon Methods in O.R. and S. Analysis
4. Sharma, S.D.: Operations Research
5. Loomba, N.P.: Linear Programming
6. Satty, T.L.: Mathematical Methods of Operations Research

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

Elective Papers Group – B (Any One) **MSMT-415(c): INTEGRAL EQUATIONS - II**	
UNIT - 1	Fredholm integral equations with degenerate kernels
UNIT - 2	Fredholm's equation as limit of a finite system of linear equations. Fredholm's two fundamental relations. Hadamard's theorem. Fredholm Fundamental theorems
UNIT - 3	Green's function for Ordinary differential equation. Application of Integral transform in Boundary Value Problems. Applications of Integral Equation
UNIT - 4	Some special types of integral equations. Application of Laplace Transform to determine the solution of Volterra integral equation with convolution type kernels
UNIT - 5	Application of Fourier transform to determine the solutions of singular integral equations. Integro-differential equation

BOOKS RECOMMENDED

1. W.V.Lovaitt: Linear Integral Equation, Dover Publications, 1950.

2. Krasnov, Kiselev and MakrankoL Problem and Exercises in Integral Equations, Translated by G. Yankovsky, Mir Publishers, Moscow, 1971.
3. Mikhlim, S.G.: Integral Equations, Pergamon, Oxford, 1957
4. Triconi, F.D.: Integral Equations, Interscience, New York, 1957.
5. Pundir, S.K. and Pundir, R. Integral equations and Boundary Value Problems, Pragati Prakashan, Meerut (U.P.)
6. Chandramouli, A.B.: Integral Equations with Boundary Value Problems, Shiksha Sahitya Prakashan, Meerut (U.P.)

Duration of Paper: 03 Hours **Max. Marks: 70**

Note: Each theory paper is divided in three parts i.e. Section – A, B and C .

Section A will consist of 10 compulsory questions. There will be two questions from each unit and answer (30 words). Each question carries 2 marks.

Section B will consist of 10 questions. Two questions from each unit and the examinee will answer (250 words) one question from each Unit. Each question carries 4 marks.

Section C will consist of 5 questions, one from each unit. The examinee will answer any 03 questions (with answer limit of 500 words). Each question carries 10 marks

Elective Papers Group – B (Any One) **MSMT-415(d): ADVANCED NUMERICAL ANALYSIS - II**	
UNIT - 1	Uniform minimax polynomial approximation, Chebyshev approximations, Chebyshev Expansion, Chebyshev Polynomials. Economization of Power Series
UNIT - 2	Solution of Boundary Value Problem: Finite Difference method. Finite Difference scheme for Linear and Non-Linear Boundary Value Problems. Numerical Solution of boundary value problems of the type $y'' = f(x\,y'), y'' = f(x, y, y')$ and $y'' = f(x, y)$.
UNIT - 3	Numerical Solution of Partial Differential Equations: Finite difference Approximation to partial derivatives. Numerical solution of linear Partial Differential Equations
UNIT - 4	Solution of Laplace, poisson, one dimensional heat and wave equation by the method of separation of variables
UNIT - 5	Shooting method for numerical solution of boundary value problems
BOOKS RECOMMENDED	
1. Jain, M.K.,Iyenger, SRK, Jain R.K.:: Numerical Methods for Scientists & Engineering Computations, Wiley Eastern Ltd., 2. Jain, M.K. : Numerical Solution of Differential Equations, New Age International. 3. Shastry, S.S.: Introductory Methods of Numerical Analysis, Prentice Hall India Pvt., Ltd., 4. Grewal, B.S. : Numerical Methods in Engineering & Science, Khanna Publishers. 5. Collatz, L.: Numerical Solution of Differential Equations, Tata McGraw-Hill. 6. D.S. Chouhan: Numerical Methods, JPH.	

SKILL DEVELOPMENT COURSE

Elective Papers Group – B (Any One) MSMT-415(d): ADVANCED NUMERICAL ANALYSIS - II	
MSMSC-1	**Knowledge of Basic software- I** Use of Scientific calculator MS82 and MS100 to solve algebraic and transcendental equations, use of MS WORD
MSMSC-2	**Knowledge of Basic software- II** Use of MS EXCEL for various functions and plotting of graphs, Power point presentation: various Functions and applications of PPT
MSMSC-3	**Knowledge of SPSS – I** An overview of SPSS for windows step by step SPSS windows processes: mouse and keyboard processing, frequently used dialogue boxes, editing output, printing result, the options option creating and editing a data file Managing data: listing cases, replacing missing values, computing new variables, recoding variables, exploring data, selecting cases, sorting cases, merging files Graphs: creating and editing graphs and charts Frequencies: frequencies, ar charts, histograms, percentiles Descriptive statistics: measure of central tendencies, variability, deviation from normality, size and stability
MSMSC-4	**Knowledge of SPSS – II** Cross tabulation and chi-square (x^2) analysis Bivariate correlation: bivariate correlations, partial correlations and the correlations matrix, The t-test procedure: independent samples, paired samples and one-sample tests The one-way anova procedure: one way analysis of variance General linear model: two ways analysis of variance General linear models: three ways analysis of variance and the influence of covariates, simple linear regression
MSMSC-5	**Sampling and Test of Significance-I** Types of Sampling: Random and non Random sampling. Test of significance: Null hypothesis, Alternate hypothesis, level of significance, Degree of freedom, test calculation, critical values and conclusion. Large sample test: Z Test, Standard error, critical values. Small sample test: Student's t test and X^2 test

SEMESTER- I

MSMT- 111: Algebra – I
MSMT- 112: Advanced Real Analysis
MSMT- 113: Differential Equations
MSMT- 114: Special Functions
MSMT- 115: Analytical Dynamics and Numerical Analysis - I

SEMESTER – II

MSMT-211: Algebra – II
MSMT-212: Measure Theory and Integration
MSMT-213: Hydrodynamics
MSMT-214: Classical Polynomials and Integral Transforms
MSMT-215: Analytical Dynamics and Numerical Analysis - II

SEMESTER - III

MSMT-311: Complex Analysis
MSMT- 312: Tensor Analysis
MSMT- 313: Functional Analysis – I
MSMT-314: Any one from Elective Course from **Group – A***
MSMT- 315: Any one from Elective Courses from **Group – B***

SEMESTER – IV

MSMT-411: Topology
MSMT- 412: Differential Geometry
MSMT- 413: Functional Analysis – II
MSMT-414: Any one from Elective Courses from **Group – A***
MSMT- 415: Any one from Elective Courses from **Group – B***

***List of Elective Papers (for Semester – III)**

Group – A	**Group – B**
314(a)Magnetofluid Dynamics - I	315(a) Generalized Functions - I
314(b)Linear Operators in Hilbert Space-I	315(b) Fundamental of Operations Research-I
314(c)Laminar Viscous Flow Theory-I	315(c) Integral Equations and Boundary Value Problems-I
314(d)Probability and Statistical Distributions-I	315(d) Advanced Numerical Analysis – I

***List of Elective Papers (for Semester – IV)**

Group – A	**Group – B**
414(a)Magnetofluid Dynamics - II	415(a) Generalized Functions - II
414(b)Linear Operators in Hilbert Space-II	415(b)Fundamental of Operations Research-II
414(c)Laminar Viscous Flow Theory-II	415(c) Integral Equations and Boundary Value Problems-II
414(d)Probability and Statistical Distributions-II	415(d) Advanced Numerical Analysis - II