Study & Evaluation Scheme

of

Master of Science (Mathematics)

[Applicable for Academic Session 2020-21]

[As per CBCS guidelines given by UGC]

TEERTHANKER MAHAVEER UNIVERSITY

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TEERTHANKER MAHAVEER UNIVERSITY
(Established under Govt. of U.P. Act No. 30, 2008)
Delhi Road, Bagarpur, Moradabad (U.P.)

Study & Evaluation Scheme	
SUMMARY	
Institute Name	*Faculty of Engineering*
Programme	*M.Sc. Mathematics*
Duration	*Two Years full time(Four Semesters)*
Medium	*English*
Minimum Required Attendance	*75%*
Credits	
Maximum Credits	*105*
Minimum Credits Required for Degree	*100*

Assessment:

Evaluation			**Internal**	**External**	**Total**
Theory			40	60	100
Practical/ Dissertations/ Project Reports/ Viva-Voce			50	50	100
Class Test-1	**Class Test-2**	**Class Test-3**	**Assignment(s)**	**Attendance & Participation**	**Total**
Best two out of three					
10	10	10	10	10	40
Duration of Examination			**External**	**Internal**	
			3 Hours	1.5 Hours	

To qualify the course a student is required to secure a minimum of 45% marks in aggregate including the semester end examination and teachers continuous evaluation.(i.e. both internal and external). A candidate who secures less than 45% of marks in a course shall be deemed to have failed in that course. The student should have at least 45% marks in aggregate to clear the semester.

 # Provision for delivery of 25% content through online mode.

 # Policy regarding promoting the students from semester to semester & year to year. No specific condition to earn the credit for promoting the students from one semester to next semester.

 # Maximum no of years required to complete the program: N+2 (N=No of years for program)

Question Paper Structure	
1	*The question paper shall consist of six questions. Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question no. 2 to 6 (from Unit-I to V) shall have explanatory answers (approximately 350 to 400 words) along with having an internal choice within each unit.*
2	*Question No. 1 shall contain 8 parts from all units of the syllabus with at least one question from each unit and students shall have to answer any five, each part will carry 2 marks.*
3	*The remaining five questions shall have internal choice within each unit; each question will carry 10 marks.*
IMPORTANT NOTES:	
1	*The purpose of examination should be to assess the Course Outcomes (CO) that will ultimately lead to of attainment of Programme Specific Outcomes (PSOs). A question paper must assess the following aspects of learning: Remember, Understand, Apply, Analyze, Evaluate & Create (reference to Bloom's Taxonomy).*
2	*Case Study is essential in every question paper (wherever it is being taught as a part of pedagogy) for evaluating higher-order learning. Not all the courses might have case teaching method used as pedagogy.*
3	*There shall be continuous evaluation of the student and there will be a provision of fortnight progress report.*

Program Structure-M.Sc. Mathematics

A. Introduction:

M.Sc. Mathematics is a two-year post-graduate programme designed to extend students knowledge and refine their abilities to solve complex problems accurately. M.Sc. Mathematics introduces students to a wide choice of modules in interesting areas such as Abstract Algebra, Real Analysis, Complex Analysis, Topology, Operation research, graph theory & number theory etc. This programme also gives an opportunity for students to conduct independent researches in pure to applied mathematics. Besides the programme, focuses on propelling students' numeracy skills and the ability to use mathematical concepts to the model the solution to mathematical problems. The programme also enables the students to develop the ability to consolidate and communicate mathematics logically and briefly in a variety of forms. Students who want to pursue higher education in the field of Mathematics can opt for PhD in the same discipline.

The programme structure and credits for M.Sc. are finalized based on the stakeholders' requirements and general structure of the programme. Minimum number of classroom contact teaching credits for the M.Sc. program will be 90 credits (one credit equals 1.0 hour) and Project will be of 15 credits. However, the minimum number of the credits for award of M.Sc. degree will be 105 credits. Out of 90 credits of classroom contact teaching, 60 credits are to be allotted for core courses (CC), 07 credits are allotted to Ability-Enhancement Compulsory Course (AECC), 02 credits are allotted to Skill-Enhancement Compulsory Course (SEC), 05 credits are allotted to Generic Elective Course (OEC/GEC), 15 credits are allotted to Program/Discipline Specific Elective Course (DSEC). Credits distribution is given below in tabular form:

M.Sc. Mathematics : Two-Year (4-Semester) CBCS Programme			
Basic Structure: Distribution of Courses			
S. No.	**Type of Course**	**Credit Hours**	**Total Credits**
1	Core Course (CC)	12 Courses of 5 Credits each (Total Credit Hrs. 12X5)	60
2	Ability-Enhancement Compulsory Course (AECC)	1 Courses of 4 Credits each (Total Credit Hrs. 1X4) 1 Courses of 3 Credits each (Total Credit Hrs. 1X3)	07
3	Skill-Enhancement Compulsory Course (SEC)	1 Courses of 2 Credits each (Total Credit Hrs. 1X2)	02
4	Open/Generic Elective Course (OEC/GEC)	1 Courses of 4 Credits each (Total Credit Hrs. 1X4) 1 Courses of 1 Credits each (Total Credit Hrs. 1X1)	05
5	Program/Discipline Specific Elective Course (DSEC)	3 Courses of 5 Credits each (Total Credit Hrs. 3X5)	15
6	Value Added Course (VAC)	4 Courses of 0 Credits each (Total Credit Hrs. 6X0)	00
8	PROJ-Viva Voce	1 Courses of 6 Credits each (Total Credit Hrs. 1X6) 1 Courses of 9 Credits each (Total Credit Hrs. 1X9)	15
9	LC (Laboratory Courses)	1 Courses of 1 Credits each (Total Credit Hrs. 1X1)	01
10	MOOC-Optional (credits will consider only in case a student fails to secure minimum required credits for the award of degree)	2 Courses of 0 Credits each (Total Credit Hrs. 2X0)	00
Total Credits			**105**

Contact hours include work related to Lecture, Tutorial and Practical (LTP), where our institution will have flexibility to decide course wise requirements.

B. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) is a versatile and flexible option for each student to achieve his target number of credits as specified by the UGC and adopted by our University.

The following is the course module designed for the M.Sc. program:

- ***Core competency:*** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. We are offered core course in all semesters like operation research, Differential Equation, Real Analysis, Topology, Number Theory etc with the 4 & 5 credit of each.

- ***Program/Discipline Specific Elective Course (DSEC):*** A Post graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding of both theoretical and experimental/applied mathematics knowledge in various fields of interest like Statistics Software & Tools, Numerical Techniques & its lab etc.

- ***Skilled communicator:*** The course curriculum incorporates basics and advanced training in order to make a post graduate student capable of expressing the subject through technical writing as well as through oral presentation.

- ***Critical thinker and problem solver:*** The course curriculum also includes components that can be helpful to post graduate students to develop critical thinking ability by way of solving problems/numerical using basic & advance knowledge and concepts of mathematics.

- ***Sense of inquiry:*** It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.

- ***Skilled project manager:*** The course curriculum has been designed in such a manner as to enabling a post graduate student to become a skilled project manager by acquiring knowledge about mathematical project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

- ***Ethical awareness/reasoning:*** A post graduate student requires understanding and developing ethical awareness/reasoning which the course curriculums adequately provide.

- ***Lifelong learner:*** The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

- ***Value Added Course (VAC):*** A Value Added Course is a non-credit course which is basically meant to enhance general ability of students in areas like soft skills, quantitative aptitude and reasoning ability - required for the overall development of a student and at the same time crucial for industry/corporate demands and requirements. The student possessing these skills will definitely develop acumen to perform well during the recruitment process of any premier organization and will have the desired confidence to face the interview. Moreover, these skills are also essential in day-to-day life of the corporate world. The aim is to nurture every student for making effective communication, developing aptitude and a general reasoning ability for a better performance, as desired in corporate world. There shall be Two courses of Aptitude in Semester I, II semesters and two courses of Soft Skills in I & II Semesters and will carry no

credit, however, it will be compulsory for every student to pass these courses with minimum 45% marks to be eligible for the certificate. These marks will not be included in the calculation of CGPI. Students have to specifically be registered in the specific course of the respective semesters.

- ***Skill Enhancement Course:*** This course may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge. We offer one SECs course as Lab in IV Semester with 2 credits.

C. Programme Specific Outcomes (PSOs)

The learning and abilities or skills that a student would have developed by the end of three-years M.Sc Mathematics**:**

PSO – 1	**Understanding** the skills set required in industries, laboratories, Banks, Insurance Companies, Educational/Research institutions, Administrative positions.
PSO – 2	**Applying** the knowledge for Professional Growth: Keep on discovering new avenues in the chosen field and exploring areas that remain conducive for research and development.
PSO – 3	**Applying** Skills like time management, crisis management, stress interviews and working as a team for successful career.
PSO – 4	**Analyzing the** problems by using problem solving skills and apply them independently to problems in pure and applied mathematics.
PSO – 5	**Evaluating** quantitative models arising in social science, business and other contexts.
PSO – 6	**Creating** and applying appropriate techniques, resources and modern technology in multidisciplinary environment.

D. Pedagogy & Unique practices adopted:

"Pedagogy is the method and practice of teaching, especially for teaching an academic subject or theoretical concept". In addition to conventional time-tested lecture method, the institute will **emphasize on experiential learning:**

- ***Role Play & Simulation:*** Role-play and simulation are forms of experiential learning. Learners take on different roles, assuming a profile of a character or personality, and interact and participate in diverse and complex learning settings. Role-play and simulation function as learning tools for teams and groups or individuals as they "play" online or face-to-face. They alter the power ratios in teaching and learning relationships between students and educators, as students learn through their explorations and the viewpoints of the character or personality they are articulating in the environment. This student-centered space can enable learner-oriented assessment, where the design of the task is created for active student learning. Therefore, role-play& simulation exercises such as virtual share trading, marketing simulation etc. are being promoted for the practical-based experiential learning of our students.

- ***Video Based Learning (VBL) & Learning through Movies (LTM):*** These days technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Video-based learning has become an indispensable part of learning. Similarly, students can learn various concepts through movies. In fact, many teachers give examples from movies during their discourses. Making students learn few important theoretical concepts through VBL & LTM is a good idea and method. The learning becomes really interesting and easy as videos add life to concepts and make the learning engaging and effective. Therefore, our institute is promoting VBL & LTM, wherever possible.

- ***Field/Live Projects*:** The students, who take up experiential projects in companies, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other their regular classes.

- ***Industrial Visits:*** Industrial visit are essential to give students hand-on exposure and experience of how things and processes work in industries. Our institute organizes such visits to enhance students' exposure to practical learning and work out for a report of such a visit relating to their specific topic, course or even domain.

- ***MOOCs:*** Students may earn credits by passing MOOCs as decided by the college. Graduate level programs may award Honors degree provided students earn pre-requisite credits through MOOCs.
  University allows students to undertake additional subjects/course(s) (In-house offered by the university through collaborative efforts or courses in the open domain by various internationally recognized universities) and to earn additional credits on successful completion of the same. Each course will be approved in advance by the University following the standard procedure of approval and will be granted credits as per the approval.
  Keeping this in mind, University proposed and allowed a maximum of two credits to be allocated for each MOOC courses. In the pilot phase it is proposed that a student undertaking and successfully completing a MOOC course through only NPTEL could be given 2 credits for each MOOC course.
  For smooth functioning and monitoring of the scheme the following shall be the guidelines for MOOC courses, Add-on courses carried out by the College from time to time.

  a) This is recommended for every student to take at least one MOOC Course throughout the programme.
  b) There shall be a MOOC co-ordination committee in the College with a faculty at the level of Professor heading the committee and all Heads of the Department being members of the Committee.
  c) The Committee will list out courses to be offered during the semester, which could be requested by the department or the students and after deliberating on all courses finalize a list of courses to be offered with 2 credits defined for each course and the mode of credit consideration of the student. The complete process shall be obtained by the College before end of June and end of December for Odd and Even semester respectively of the year in which the course is being offered. In case of MOOC course, the approval will be valid only for the semester on offer.
  d) Students will register for the course and the details of the students enrolling under the course along with the approval of the Vice Chancellor will be forwarded to the Examination department within fifteen days of start of the semester by the Coordinator MOOC through the Principal of the College.
  e) After completion of MOOC course, Student will submit the photo copy of Completion certificate of MOOC Course to the Examination cell as proof.
  f) Marks will be considered which is mentioned on Completion certificate of MOOC Course.
  g) College will consider the credits only in case a student fails to secure minimum required credits then the additional subject(s) shall be counted for calculating the minimum credits required for the award of degree.

- ***Special Guest Lectures (SGL) &Extra Mural Lectures (EML):*** Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific industry/domain to make things/concepts clear for a better understanding from the perspective of

the industry. Hence, to cater to the present needs of industry we organize such lectures, as part of lecture-series and invite prominent personalities from academia and industry from time to time to deliver their vital inputs and insights.

- ***Student Development Programs (SDP):*** Harnessing and developing the right talent for the right industry an overall development of a student is required. Apart from the curriculum teaching various student development programs (training programs) relating to soft skills, interview skills, SAP, Advanced excel training etc. that may be required as per the need of the student and industry trends, are conducted across the whole program. Participation in such programs is solicited through volunteering and consensus.

- ***Industry Focused programes:*** Establishing collaborations with various industry partners to deliver the programme on sharing basis. The specific courses are to be delivered by industry experts to provide practice based insight to the students.

- ***Special assistance programe for slow learners & fast learners:*** write the note how would you identify slow learners, develop the mechanism to correcting knowledge gap. Terms of advance topics what learning challenging it will be provided to the fast learners.

- ***Induction program:*** Every year 3 weeks induction program is organized for 1st year students to make them familiarize with the entire academic environment of university including Curriculum, Classrooms, Labs, Faculty/ Staff members, Academic calendar and various activities.

- **Mentoring scheme:** There is Mentor-Mentee system. One mentor lecture is provided per week in a class. Students can discuss their problems with mentor who is necessarily a teaching faculty. In this way, student's problems or issues can be identified and resolved.

- **Extra-curricular Activities:** organizing & participation in extracurricular activities will be mandatory to help students develop confidence & face audience boldly. It brings out their leadership qualities along with planning & organizing skills. Students undertake various cultural, sports and other competitive activities within and outside then campus. This helps them build their wholesome personality.

- **Career & Personal Counseling:** - Identifies the problem of student as early as possible and gives time to discuss their problems individually as well as with the parents. Counseling enables the students to focus on behavior and feelings with a goal to facilitate positive change.
  Its major role lies in giving: Advice, Help, Support, Tips, Assistance, and Guidance.
  Strategies: a) Once in a week the counselors meet the students in order to inquire about problems. b) Available 24x7 on SOS basis.
- **Participation in Workshops, Seminars & writing & Presenting Papers:** Departments plan to organize the workshops, Seminars & Guest lecturers time to time on their respective topics as per academic calendar. Students must have to attend these programs. These participation would be count in the marks of general Discipline & General Proficiency which is the part of course scheme as noncredit course.
- **Formation of Student Clubs, Membership & Organizing & Participating events:** Every department has the departmental clubs with the specific club name. The entire student's activity would be performed by the club. One faculty would be the coordinator of the student clubs & students would be the members with different responsibility.

- **Capability Enhancement & Development Schemes:** The Institute has these schemes to enhance the capability and holistic development of the students. Following measures/ initiatives are taken up from time to time for the same: Career Counseling, Soft skill development, Remedial Coaching, Bridge Course, Language Lab, Yoga and Meditation, Personal Counseling

- **Library Visit & Utilization of E-Learning Resources:** Student can visit the library from morning 10 AM to evening 8 PM. Library created its resources Database and provided Online Public Access Catalogue (OPAC) through which users can be accessed from any of the computer connected in the LAN can know the status of the book. Now we are in process to move from OPAC to KOHA.
  - **a)** Institute Library & Information is subscribing online e-books and e-journals databases (DELNET and EBSCO host E-databases) as per the requirement of the institute and fulfilling AICTE norms. IP based access is given to all computers connected on campus LAN to access e-journals.
  - **b)** For the effective utilization of resources, Information Literacy training programs are conducted to the staff and students.
  - **c)** Wi-Fi enabled campus
  - **d)** Regular addition of latest books and journals
  - **e)** Well maintained e-library to access e-resources

Study & Evaluation Scheme

M.Sc. (Mathematics)-Semester I

S. No	*Category*	*Course Code*	Course	*Periods*			*Credit*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-1	MAT111	Differential Equation	4	1	-	5	40	60	100
2	CC-2	MAT112	Real Analysis	4	1	-	5	40	60	100
3	CC-3	MAT113	Linear Algebra	4	1	-	5	40	60	100
4	AECC-1	MAT115	Research Methodology	3	1	-	4	40	60	100
5	GEC-1		Generic Elective Course	Generic Elective-I	3	1	-	4	40	60	100
6	GEC-2		Generic Elective Course	Generic Elective-2	-	-	2	1	50	50	100
7	DGP-1	MGP111	Discipline & General Proficiency		**-**	**-**	**-**	**-**	100	-	100
			Total		**18**	**5**	**2**	**24**	**250**	**350**	**600**

Value Added Course:
It is an audit course. The performance of the student in this course will not be counted in the overall result however the student has to pass it compulsorily with 45% marks.

1	VAC-1	TMUPA-101	Elementary Arithmetic & Analytical Reasoning	2	1	-	-	40	60	100
2	VAC-2	TMUPS-101	Managing Self	2	1	-	-	50	50	100

M.Sc. (Mathematics)-Semester II

S. No	*Category*	*Course Code*	Course	*Periods*			*Credit*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-4	MAT211	Complex Analysis	4	1	-	5	40	60	100
2	CC-5	MAT212	Advance Abstract Algebra	4	1	-	5	40	60	100
3	CC-6	MAT213	Numerical Techniques	4	1	-	5	40	60	100
4	CC-7	MAT214	Topology	4	1	-	5	40	60	100
5	CC-8	MAT215	Operation Research	4	1	-	5	40	60	100
6	LC-1	MAT261	Numerical Techniques (Lab)	-	-	2	1	50	50	100
7	DGP-2	MGP211	Discipline & General Proficiency	**-**	**-**	**-**	**-**	100	-	100
			Total	**20**	**5**	**2**	**26**	**250**	**350**	**600**

***Value Added Course:**

1	VAC-3	TMUPA-201	Progressive Algebra & Data Management	2	1	-	-	40	60	100
2	VAC-4	TMUPS-201	Managing Work and Others	2	1	-	-	50	50	100

MOOC Course:

1	MOOC-1	MOOC12	MOOC Program –I (Optional)	-	-	-	2	-	100	100

M.Sc. (Mathematics)-Semester III

S. No	*Category*	*Course Code*	**Course**		*Periods*			*Credit*	*Evaluation Scheme*		
					L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-9	MAT311	Functional Analysis		4	1	-	5	40	60	100
2	CC-10	MAT312	Partial Differential Equations		4	1	-	5	40	60	100
3	AECC-2	MHM320	Human values & Professional Ethics		3	-	-	3	40	60	100
4	DSE-1		Discipline Specific Elective Courses	Discipline Specific Elective Course-I	4	1	-	5	40	60	100
5	DSE-2			Discipline Specific Elective Course-II	4	1	-	5	40	60	100
6	PROJ-1	MAT392	Industrial Training & Presentation		-	-	12	6	50	50	100
7	DGP-3	MGP311	Discipline & General Proficiency		**-**	**-**	**-**	**-**	100	-	100
			Total		**19**	**4**	**12**	**29**	**250**	**350**	**600**

MOOC Course:

1	MOOC-2	MOOC13	MOOC Program –II (Optional)	-	-	-	2	-	100	100

M.Sc. (Mathematics)-Semester IV

S. No	*Category*	*Course Code*	**Course**	*Periods*			*Credit*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-12	MAT411	Number Theory	4	1	-	5	40	60	100
2	CC-13	MAT412	Advance Discrete Mathematics	4	1	-	5	40	60	100
3	DSE-3		Discipline Specific Elective Courses: Discipline Specific Elective Course-III	4	1	-	5	40	60	100
4	SEC-1	MAT461	MATLAB Programming	-	1	2	2	50	50	100
5	PROJ-2	MAT492	Project	**-**	**-**	18	9	50	50	100
6	DGP-4	MGP411	Discipline & General Proficiency	**-**	**-**	**-**	**-**	100	-	100
			Total	**12**	**4**	**20**	**26**	**220**	**280**	**500**

ELECTIVE COURSES OFFERED

S. No	Code	Course	L	T	P	Credit
Semester I - Generic Elective I						
1	MAT116	Computer System & Programming in C++	3	1	0	4
Semester I- Generic Elective II (Lab)						
2	MAT161	Computer System & Programming in C++ (Lab)	-	-	2	1
Semester III- Discipline Specific Elective Course-I -(Any one)						
3	MAT314	Graph Theory	4	1	0	5
4	MSC014	Database Management System	4	1	0	5
Semester III- Discipline Specific Elective Course-II -(Any one)						
5	MAT315	Probability & Mathematical Statistics	4	1	0	5
6	MSC013	Statistical Techniques in Data Mining	4	1	0	5
Semester IV- Discipline Specific Elective Course-III -(Any one)						
7	MAT414	Fuzzy sets & its application	4	1	0	5
8	MAT415	Calculus of variations and Integral Equation	4	1	0	5

Course Code: MAT111	**M.Sc. (Mathematics)- Semester-I** **Differential Equation**	**L-4 T-1 P-0 C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concept of differential equation and analytical techniques to evaluate the solution of second order ordinary differential equations with constant coefficient.	
CO2.	**Understanding** the concepts of second and higher order linear differential equations with variable coefficients.	
CO3.	**Analyzing** the intangibility of a differential equation and finding the solution of total differential equation.	
CO4.	**Applying** the concept of existence and uniqueness of solutions under initial and boundary conditions.	
CO5.	**Applying** the concept of Picard's iterative methods the solution.	
Course Content:		
Unit-1:	Linear differential equations with constant coefficients; Initial value problems for second order equations; Second order homogeneous differential equation; Wronskian and its theorem, linear dependence and independence of solutions by Wronskian.	**8 Hours**
Unit-2:	Linear equations with variable coefficients: Method of reduction, Rule to finding out part of the C.F, Removal of first derivative, Changing of independent variable, Variation of parameters, Simultaneous linear differential equation.	**8 Hours**
Unit-3:	Total differential equation, Necessary and sufficient condition for intangibility of a single differential equation, special method I: solution by inspection, special method II: solution of homogeneous equation.	**8 Hours**
Unit-4:	Power series method, Ordinary point, Solution of the differential equation when x=0 is an ordinary point, Singular point about x=a, Singular point about x=0, Frobenius method with all cases.	**8 Hours**
Unit-5:	Picard's iterative methods, Existence and Uniqueness solutions, Lipschitz condition, Existence Theorem, Uniqueness solutions.	**8 Hours**
Text Books:	**1.** E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice-Hall of India.	
Reference Books:	**1.** G. Birkhoff and G.C. Rota, Ordinary differential equations, John Wiley and Sons. **2.** S. G. Deo, V. Lakshmi Kantham, V. Raghvendra, Text book of ordinary Differential Equations, Tata Mc-Graw Hill. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	• https://www.youtube.com/watch?v=VyWBA0THDRk • https://www.youtube.com/watch?v=tHqx1qxA8q4 • https://www.youtube.com/watch?v=BRKs2SL2YSc • https://www.youtube.com/watch?v=UbwM3qOrXCA	

Course Code: MAT112	**M.Sc. Mathematics- Semester-I** **Real Analysis**	**L-4 T-1 P-0 C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of open & closed sets.	
CO2.	**Understanding** the properties of Riemann Integrability and theorems on Riemann Integration.	
CO3.	**Understanding** the bounded, convergent, divergent, Cauchy and monotonic sequences and calculate their limit superior, limit inferior, and the limit of a bounded sequence.	
CO4.	**Understanding** the concepts of implicit functions and optimizes the functions of several variables.	
CO5.	**Applying** the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence.	
Course Content:		
Unit-1:	**Riemann Stieltjes Integral:** Definition, Lower and Upper Riemann-Stieltjes integral, Existence of Reimann- Stieltjes integral; Reimann- Stieltjes sum as a limit of sum, Inequalities of Reimann- Stieltjes, Algebra of Reimann- Stieltjes,	**8 Hours**
Unit-2:	**Uniform convergence of Sequences and series of functions:** Continuity of the uniform limit of a uniformly convergent sequence, Test for the uniform convergence of a series, Abel's test and Dirichlet's test, Properties of Uniform convergence series; Weierstrass approximation theorem.	**8 Hours**
Unit-3:	Power series; Algebra of power series; Uniqueness theorem for power series; Abel's and Tauber's theorems.	**8 Hours**
Unit-4:	Functions of several variables; Simultaneous and iterated limits; Partial derivatives; Interchange of the order of differentiation; Linear transformation; Derivatives in an open subset of R^n; Derivatives of higher orders; Taylor's theorem.	**8 Hours**
Unit-5:	Implicit function; Implicit function theorem (without proof); Derivative of Implicit function; Jacobian, Stationary values under constraints.	**8 Hours**
Text Books:	**1.** Walter Rudin, Principles of Mathematical Analysis, McGraw-Hill.	
Reference Books:	**1.** T. M. Apostol, Mathematical Analysis, Narosa Publishing. **2.** J. White, Real Analysis, An Introduction, Addison-Wesley Publishing. **3**. H. L. Royden, Real Analysis, Macmillan Publishing Co. Inc. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	**https://www.youtube.com/watch?v=TpKIeWgcmC8** **https://www.youtube.com/watch?v=MTqvlRfj8II**	

Course Code: MAT113	M.Sc. Mathematics- Semester-I **Linear Algebra**	L-4 T-1 P-0 C-5
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the structures, Vector space, subspaces and analyzing the effect of independency of vectors.	
CO2.	**Understanding** the concept of Linear transformation and their matrix representation.	
CO3.	**Understanding** of Inner product space and formation of ortho normal basis using Gram Schmidt Method.	
CO4.	**Understanding** the concepts of Bilinear Forms for Symmetric & skew Symmetric.	
CO5.	**Analyzing** the system of linear equations, consistency and dependency.	
Course Content:		
Unit-1:	Vector Spaces: Definition, General properties of vector spaces; Vector subspaces; Algebra of subspaces; Linear Spans; Row space of Matrix; Linear dependence and independence of vectors; Finite-dimensional vector spaces; Dimension of vector space and sub-spaces; Quotient spaces; Coordinates.	**8 Hours**
Unit-2:	Vectors in Rn; Curves in Rn; Matrices: Addition and scalar multiplication, Transpose of matrix, Square matrices; Systems of linear equations; Cayley-Hamilton Theorem; Hermitian & Skew-Hermitian and unitary matrices; Powers of Matrices; Polynomials in Matrices; Invertible Matrices; Special types of Square Matrices; Complex and Block Matrices; Diagonalization; Eigen values and Eigen vectors; Minimal polynomial.	**8 Hours**
Unit-3:	Linear Transforms; Linear operator; Range and null space of a linear Transformation; Rank and nullity; Product of linear Transformation; Singular Transformation; Representation of linear Transformation by matrix; Dual spaces; Dual Bases.	**8 Hours**
Unit-4:	Inner Product Spaces: Definition, Euclidean and unitary spaces; Norm and length of vector; Cauchy-Schwarz's inequality and Applications; Orthogonality, Orthogonal Sets and Basis, Gram- Schmidt orthogonalization process; self-adjoint operators, Complex Inner Product Spaces; Unitary and Normal operators; Spectral theorem.	**8 Hours**
Unit-5:	Bilinear Forms: Definition, Bilinear form as vectors; Matrix of a bilinear form; Symmetric & skew Symmetric bilinear forms.	**8 Hours**
Text Books:	**1**. Sharma &Vashistha, Linear Algebra, Krishna Prakashan Ltd.	
Reference Books:	**1.** Schaum's series Linear Algebra, Tata McGraw- Hill. **2.** Kenneth Hoffman & Ray Kunze, Linear Algebra, Pearson Education. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	• https://www.youtube.com/playlist?list=PLE7DDD91010BC51F8 • https://www.youtube.com/playlist?list=PLOzRYVm0a65e-_mfWrLHKHY3Fyl707EfJ	

Course Code: MAT115	**M.Sc. Mathematics- Semester-I** **Research Methodology**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** basic concepts of research and its methodologies, sampling techniques, meaning of scaling, its classification, important scaling techniques, basic principles of graphical representation	
CO2.	**Identifying** appropriate research topics using better central tendency and dispersion procedures	
CO3.	**Analyzing** different research problem and their associated parameters, hypothesis with significance levels and different degree of freedoms, correlation and regression	
CO4.	**Evaluating** appropriate project proposal (to undertake a project), significance of report writing, layout and precautions for writing research report	
CO5.	**Creating,** organizing and conducting research (advanced project) in a more appropriate manner with the help of SPSS for data analysis	
Course Content:		
Unit-1:	**Research Methodology**: Introduction to Research methodology: Meaning, Objective, Types of research & research approaches, Criteria for Good research .Review of Literature. Research problem: Statement, Purpose, Objective, Necessity of defining the problems. Research design: Meaning, Need Features, Different research design.	**8 Hours**
Unit-2:	**Measurement of scaling techniques**: Measurement scales, sources of error in measurement, technique of developing measurement tools, Meaning of scaling, its classification, important scaling techniques. Methods of collection, Sampling Techniques.	**8 Hours**
Unit-3:	**Introduction to statistics:** Meaning, Definition, Characteristics, importance of the study of statistics, Tabulation of Data: Basic principles of graphical representation, Types of diagrams histograms, frequency polygons, smooth frequency polygons, cumulative frequency curve. Measures of central Tendency: Mean, Median, Mode, Measures of Dispersion: Range, Mean deviation and Standard deviation.	**8 Hours**
Unit-4:	Testing of Hypotheses, Level of significance, Degree of freedom, Student t-test, F- test, Chi Square-test, Anova-one way & two way; Correlation & Regression: Significance, Types of Correlation, Linear Regression	**8 Hours**
Unit-5:	**Interpretation and report writing**: Meaning, Techniques of interpretation, significance of report writing, steps in writing, layout of the research report, types of report and precautions for writing research report. Use of SPSS in Data Analysis.	**8 Hours**

Text & Reference Books:	1. Dr. J. A Khan: Biostatistics & Research Methodology, APH Publishing. 2. C. R Kothari: Research Methodology, Methods & techniques New age international Publishers. 3. R. Paneerselvam Research Methodology, PHI Learning Second Edition. 4. Kapoor B.K & Gupta S.C, Fundamental of Statistics, S. Chand Publication, New Delhi. 5. Malhotra Naresh K. Marketing Research, Pearson Education. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	https://www.youtube.com/watch?v=DiR84ZS4nRg https://www.youtube.com/watch?v=GVmQpGn-Zuo	

Course Code: MGP111	M.Sc. Mathematics- Semester-I **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd & IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal

Course Code: TMUPA-101	VAC (Value Added Course) M.Sc. Mathematics (Semester-I) **Elementary Arithmetic & Analytical reasoning**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Operationalizing the inter-related concept of Percentage in Profit Loss and Discount.	
CO2.	Applying the arithmetical concepts in Ratio and Proportion, Mixture and Allegation.	
CO3.	Employing the techniques of Percentage, Ratios and Average in inter related concepts of Time and Work, Time speed and Distance.	
CO4.	Evaluating the different possibilities of various reasoning based problems in series, Direction and Coding-Decoding.	
Course Content:		
Unit-1:	**Percentages** Basic calculation, ratio equivalent, base, change of base, multiplying factor, percentage change, increment, decrement, successive percentages, word problems	**4 Hours**
Unit-2:	**Profit Loss Discount** Basic definition, formula, concept of mark up, discount, relation with successive change, faulty weights	**3 Hours**
Unit-3:	**Ratio, proportions and variations** Concept of ratios, proportions, variations, properties and their applications	**3 Hours**
Unit-4:	**Mixtures and allegations** Mixtures of 2 components, mixtures of 3 components, Replacements	**4 Hours**
Unit-5:	**Time and Work** Same efficiency, different efficiency, alternate work, application in Pipes and Cisterns	**4 Hours**
Unit-6:	**Time Speed Distance** Average speed, proportionalities in Time, Distance, trains, boats, races, circular tracks	**6 Hours**
Unit-7:	**Number and Alphabet Series** Different kind of series and pattern	**2 Hours**
Unit-8:	**Direction sense** Simple statements, shadow type	**2 Hours**
Unit-9:	**Coding and decoding** Sequential coding, reverse coding, abstract coding	**2 Hours**
Reference Books:	• R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude • R2:-Quantitative Aptitude by R.S. Agrawal • R3:-M Tyra: Quicker Maths • R4:-Nishith K Sinha:- Quantitative Aptitude for CAT • R5:-Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com • R6:-Logical Reasoning by Nishith K Sinha	

	• R7:-Verbal and Non Verbal Reasoning by R.S. Agrawal *** Latest editions of all the suggested books are recommended.**	

Course Code: TMUPS-101	Value Added Course M.Sc. Mathematics- Semester-I **Managing Self**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Utilizing effective verbal and non-verbal communication techniques in formal and informal settings	
CO2.	Understanding and analyzing self and devising a strategy for self growth and development.	
CO3.	Adapting a positive mindset conducive for growth through optimism and constructive thinking.	
CO4.	Utilizing time in the most effective manner and avoiding procrastination.	
CO5.	Making appropriate and responsible decisions through various techniques like SWOT, Simulation and Decision Tree.	
CO6.	Formulating strategies of avoiding time wasters and preparing to-do list to manage priorities and achieve SMART goals.	
Course Content:		
Unit-1:	**Personal Development:** Personal growth and improvement in personality Perception Positive attitude Values and Morals High self motivation and confidence Grooming	**10 Hours**
Unit-2:	**Professional Development:** Goal setting and action planning Effective and assertive communication Decision making Time management Presentation Skills Happiness, risk taking and facing unknown	**8 Hours**
Unit-3:	**Career Development:** Resume Building Occupational Research Group discussion (GD) and Personal Interviews	**12 Hours**
Reference Books:	**1.** Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education **2.** Tracy, Brian, Time Management (2018), Manjul Publishing House **3.** Hill, Napolean, Think and grow rich (2014), Amazing Reads **4.** Scott, S.J., SMART goals made simple (2014), Createspace Independent Pub **5.** https://www.hloom.com/resumes/creative-templates/ **6.** https://www.mbauniverse.com/group-discussion/topic.php **7.** Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan **8.** Burne, Eric, Games People Play (2010), Penguin UK **9.** https://www.indeed.com/career-advice/interviewing/job-interview-tips-how-to-make-a-great-impression *** Latest editions of all the suggested books are recommended.**	

Course Code: MAT116	**Generic Elective- I** **M.Sc. Mathematics- Semester-I** **Computer System & Programming in C++**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concept of various components of computer system	
CO2.	**Understanding** the Object-Oriented Programming Language concepts.	
CO3.	**Analyzing** basic mathematical problem and their solutions through programming	
CO4.	**Applying** the concepts of programming solutions for distinct problems	
CO5.	**Applying** the concepts of scalable solutions through function	
Course Content:		
Unit-1:	**Problem Solving**: Phases of problem solving, Algorithms, Structure Chart, Flow chart, Practice of solving Sequence Problems, Selection Problems, Repetition problem. **Statements for problem solving:** if, switch, while, for, do, break, continue, go to statements.	**8 Hours**
Unit-2:	**Concepts in Computer Application:** Generations, Characteristic and Application of Computers, Functional Component of Computer: CPU, I/O devices, Type of Memory. Translators: Assembler, Compiler, and Interpreter; Number System: Decimal, Octal, Binary and Hexadecimal &their Conversions; Various Codes: BCD, ASCII and EBCDIC and Gray Code.	**8 Hours**
Unit-3:	**Concepts in Operating System**: Purpose, Services, Types, Functions. **Data Communication & Networks:** Types, Topology, IP address classes. C++ Basics: Data types, Variables, Constants, Keywords, Identifiers, Types of Operators, Memory Allocation operators, Expressions, Pre-processor directives, Introduction to Array, Pointers, Structures and Strings.	**8 Hours**
Unit-4:	**Functions:** Scope of variables; Parameter passing; Default arguments; Inline functions; Recursive functions; Pointers to functions. **C++ Classes and Data Abstraction: Class** Structure, Objects; this pointer; Friend function; Static class members; Constructors and Destructors; Data abstraction. **Inheritance:** Types, Access to the base class members; Virtual base class.	**8 Hours**
Unit-5:	**Polymorphism:** Function overloading; Operator overloading; Static Binding and Dynamic bindings; Virtual function: Definition, Call mechanism, Pure virtual functions; Virtual destructors; Abstract Classes. **C++ I/O:** Stream classes hierarchy; Stream I/O; File streams; Overloading << and >> operators; File Modes, Reading and Writing to a file; Formatted I/O.	**8 Hours**
Text Books:	**1.** Bjarne Stroutrup, The C++ Programming Languge, Adison Wesley.	
Reference Books:	**1.** Beginning C++, The Complete Language, Horton,SPD/WROX **2.** Programming with C++, Radhaganesan, Scitech	

	3. Projects using C++, Varalaxmi, Scitech 4. Object Oriented modelling & Design, RumBaugh, PHI ***Latest editions of all the suggested books are recommended.**	
Additional electronics reference material:	1. https://www.youtube.com/watch?v=LZFoktwiars&list=PLmp4ylk-B4KrM9uOEdvPIVFUkU3jNc6D2 2. https://www.youtube.com/watch?v=XTiIiI-LOY8&list=PLJvIzs_rP6R73WlvumJvCQJrOY3U5zq1j	

Course Code: MAT161	Generic Elective- II (Lab) B.Sc.(H) Mathematics- Semester-I **Computer System & Programming in C++ (Lab)**	L-0 T-0 P-2 C-1
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of execution to programs written in C language.	
CO2.	**Applying** to prepare programming solutions for specific problems.	
CO3.	**Applying** to prepare scalable solutions through functions.	
CO4.	**Applying** basic elements of a C program including arithmetic and logical operators, functions, control structures, and arrays	
CO5.	**Analyzing** basic mathematical problem and their solutions through programming.	
Experiments:	**Note: Minimum 15 experiments should be performed:**	
Experiment-1:	Write a Program (WAP) to calculate Sum & average of N numbers.	
Experiment-2:	WAP to convert integer arithmetic to a given number of day and month.	
Experiment-3:	WAP to find maximum and minimum out of 3 numbers a, b & c.	
Experiment-4:	WAP to find factorial of positive integer.	
Experiment-5:	WAP to find sum of series up to n number, 2+5+8+……+n.	
Experiment-6:	WAP to print all the number between 1 to 100 which are dividing by 7.	
Experiment-7:	WAP to generate Fibonacci series up to n.	
Experiment-8:	WAP to calculate area of circle using Functions.	
Experiment-9:	WAP to calculate factorial of given number using Recursion function.	
Experiment-10:	WAP to find whether number is prime or not.	
Experiment-11:	WAP to find that the enter character is a letter or digit.	
Experiment-12:	WAP to find addition of two matrix of n*n order.	
Experiment-13:	WAP to find multiplication of two matrix of n*n order.	
Experiment-14:	WAP to find even or odd up to a given limit n.	
Experiment-15:	WAP to find whether a given no is palindrome or not.	
Experiment-16:	WAP to Swap two numbers using third Variable and without using third variable.	
Experiment-17:	WAP to Swap two numbers using call by value and call by reference.	

Experiment-18:	WAP illustrating overloading of various operators.	
Experiment-19:	WAP illustrating use of Friend	
Experiment-20:	WAP illustrating use of Inline Function.	
Experiment-21:	WAP illustrating use of destructor and various types of constructor.	
Experiment-22:	WAP illustrating various forms of Inheritance.	
Experiment-23:	WAP illustrating use of virtual functions, virtual Base Class.	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MAT211	**M.Sc. Mathematics- Semester-II** **Complex Analysis**	**L-4 T-1 P-0 C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of limit continuity and differentiability.	
CO2.	**Understanding** the basic properties of complex integral and their theorems.	
CO3.	**Understanding** the concept of singularity.	
CO4.	**Understanding** the concept of bilinear transformation and conformal mappings.	
CO5.	**Applying** the theorems of complex analysis to evaluate definite integrals and infinite series.	
Course Content:		
Unit-1:	Algebra of complex numbers, the complex plane, Functions of complex variables, Limit and continuity, Differentiability, Power Series as an analytic function.	**8 Hours**
Unit-2:	Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Morera's Theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem.	**8 Hours**
Unit-3:	Laurent's series, Singularities, zeroes and poles, singular point and different types of singularities, The Calculus of Residue, Residue of a pole at infinity, Residue theorem.	**8 Hours**
Unit-4:	Bilinear transformations, properties and classifications of bilinear transformations, Definitions and examples of conformal mapping, Riemann mapping theorem.	**8 Hours**
Unit-5:	Hyper-geometric Series, Generalized Hyper-geometric functions, Gamma function and its properties, Riemann Zeta function and its functional equation.	**8 Hours**
Text Books:	**1.** J.B. Conway, Narosa Complex Analysis, Publishing House.	
Reference Books:	**1.** H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford. **2.** J.B. Conway, Function of one Complex Variable, Springer-Verlag. **3.** L.V. Ahlfors, Complex Analysis, McGraw-Hill. **4.** Walter Rudin, Real and Complex Analysis, McGraw-Hill. *** Latest editions of all the suggested books are recommended.**	
Additional electronics reference material:	• https://www.youtube.com/watch?v=b5VUnapu-qs • https://www.youtube.com/watch?v=0o98Jz4euW8	

Course Code: MAT212	**M.Sc. Mathematics- Semester-II** **Advance Abstract Algebra**	**L-4 T-1 P-0 C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.	
CO2.	**Understanding** of important mathematical concepts in abstract algebra such as definition of a group, order of a finite group and order of an element.	
CO3.	**Applying** problem-solving using advanced algebraic techniques applied to diverse situations in physics, engineering and other mathematical.	
CO4.	**Analyzing** the concept of advanced algebraic techniques.	
CO5.	**Creating** capacity for mathematical reasoning through analyzing, Proving and explaining concepts from advanced algebra.	
Course Content:		
Unit-1:	Groups–Properties, Examples; subgroups, cyclic groups, homomorphism of groups and Lagrange's theorem; permutation groups, permutations as products of cycles, even and odd permutations, normal subgroups, quotient groups, isomorphism theorems.	**8 Hours**
Unit-2:	Group action; Cayley's theorem, group of symmetries, dihedral groups and their elementary properties; orbit decomposition; counting formula; class equation, consequences for p-groups; Sylow's theorems.	**8 Hours**
Unit-3:	Applications of Sylow's theorems, conjugacy classes in Sn and An, simplicity of An. Direct product; structure theorem for finite abelian groups; invariants of a finite Abelian group.	**8 Hours**
Unit-4:	Basic properties and examples of ring, domain, division ring and field; direct products of rings, characteristic of a domain, field of fractions of an integral domain; ring homeomorphisms (always unitary); ideals, factor rings, prime and maximal ideals, principal ideal domain; Euclidean domain, unique factorization domain.	**8 Hours**
Unit-5:	A brief review of polynomial rings over a field; reducible and irreducible polynomials, Gauss' theorem for reducibility of $f(x) \in Z[x]$; Eisenstein's criterion for irreducibility of $f(x) \in Z[x]$ over Q, roots of polynomials; finite fields of orders 4, 8, 9 and 27 using irreducible polynomials over Z2 and Z3.	**8 Hours**
Text Books:	**1.** "Algebra" by I. N. Hertein, Wiley and Company.	
Reference Books:	1. "Algebra" by M. Jacobson, Banz, W. H. Erconma New Delhi. **2.** "Abstract Algebra" by D. S. Malic, Mordesas, Pragati Prakashan. **3.** M. Artin, *Algebra*, Prentice-Hall of India. ***Latest editions of all the suggested books are recommended.**	
Additional electronics reference material:	https://www.youtube.com/watch?v=cWNvD_G_Qi4 https://www.youtube.com/watch?v=whMdoLfftrE	

Course Code: MAT213	**M.Sc. Mathematics- Semester-II** **Numerical Techniques**	**L-4** **T-1** **P-0** **C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** numerical techniques to find the roots of non-linear equations and solution of system of linear equations.	
CO2.	**Understanding** the difference operators and the use of interpolation.	
CO3.	**Understanding** numerical differentiation and integration and numerical solutions of ordinary and partial differential equations.	
CO4.	**Applying** numerical methods to obtain approximate solutions to numerical problems.	
CO5.	**Applying** the concepts of finite difference & interpolation methods.	
Course Content:		
Unit-1:	Interpolation: Errors in Polynomial interpolation; Finite differences: Forward, Backward and Central differences, Symbolic relations, Difference of polynomial, Newton's formulae of interpolation, Central difference interpolation formulae: Gauss's, Bessel's & Stirling's formulae, Interpolation with unevenly spaced points: Lagrange's interpolation formula, Divided differences.	**8 Hours**
Unit-2:	Errors in numerical calculations: Absolute, Relative and percentage errors, A general error formula, Error in a series approximation; Solutions of algebraic & transcendental equations: The Bisection method, The iteration method, Regula-Falsi method, Secant method, Newton- Raphson method.	**8 Hours**
Unit-3:	Numerical differentiation and integration: Forward, Backward and Central difference formulae for first and second order derivatives; Errors in numerical differentiation; Numerical integration, Trapezoidal rule; Simpson's 1/3 rule, Simpson's 3/8 rule; Boole's and Weddle's rules.	**8 Hours**
Unit-4:	Numerical solution of ordinary differential equations: Taylor's series, Picard's successive approximations, Euler's, Modified Euler's, Runge-Kutta; Simultaneous and higher order equations: Taylor's series method and Runge-Kutta method.	**8 Hours**
Unit-5:	Boundary value problems, solution of partial differential equations: Finite difference approximations to derivatives; Laplace's equation: Jacobi's method, Gauss Seidel method; Parabolic equations: Explicit scheme, C-N scheme; Hyperbolic equations: Explicit scheme, Implicit scheme.	**8 Hours**
Text Books:	**1.** Grewal B. S, Numerical Methods in Engineering and Science, Khanna Publishers.	
Reference Books:	**1.** M.K. Jain, S. R. K Iyengar & R. K. Jain, Numerical methods of Scientific and Engineering Computation, New Age Pub. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference material	https://www.youtube.com/watch?v=Aw6LvaPtESE&list=PLU6SqdYcYsfILH05ucPKWNrJCvYuvGHff https://www.youtube.com/watch?v=y725DGwii84	

Course Code: MAT261	M.Sc. Mathematics- Semester-II Numerical Techniques (Lab)	L-0 T-0 P-2 C-1
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of numerical methods.	
CO2.	**Applying** the numerical method on computer programming language.	
CO3.	**Applying** numerical integration using Simpson's 1/3, 3/8 rules & Trapezoidal rule.	
CO4.	**Applying** the numerical method to solve the differential equation using 4^{th} order Runge Kutta method.	
CO5.	**Analysis** the root of the Algebraic and Transcendental equations using Bisection Method using C programming.	
Experiments:	**Note: All experiments should be performed:**	
Experiment-1:	To implement floating point arithmetic operations i.e, addition, subtraction, multiplication and division.	
Experiment-2:	To deduce errors involved in polynomial interpolation	
Experiment-3:	Algebraic and transcendental equation using Bisection, Newton Raphson, Iterative method of False position, rate of conversions of roots in tabular form for each of these methods	
Experiment-4:	To implement formulae by Bessel's and Stirling etc.	
Experiment-5:	Gaus Interpolation, Flow chart C program & output	
Experiment-6:	Implement Numerical Differentiation	
Experiment-7:	Implement Numerical Integration using Simpson's 1/3 and 3/8 rules	
Experiment-8:	Implement Numerical Integration using Trapezoidal rule.	
Experiment-9:	Solution of Differential Equation using 4^{th} order Runge Kutta method	
Experiment-10:	Numerical Solution of ordinary first order differential equation-Euler's method with algorithm, flow chart C program and output	
Experiment-11:	Newton's and lagrange's Interpolation with algorithm, flowchart C Program and output.	
Experiment-12:	Iteration method, flowchart C Program and output	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MAT214	**M.Sc. Mathematics- Semester-II** **Topology**	**L-4 T-1 P-0 C-5**
Course Outcomes :	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of subspace, product and quotient topologies.	
CO2.	**Understand** the structure of topological spaces using continuous functions and homeomorphisms.	
CO3.	**Understanding** the concepts of Hilbert spaces and Banach spaces and their operators.	
CO4.	**Understanding** the concepts of metric spaces.	
CO5.	**Applying** the theorems of connectedness and compactness.	
Course Content:		
Unit-1:	**Metric spaces:** Metric space, Quasi metric Space, pseudo metric, Open & Closed sphere, Open set, limit Point, Convergence of a sequence, Cauchy sequence, Isometric Space, Closed set, Open set, Interior, closure	**8 Hours**
Unit-2:	**Topological space**: Topological space, Elementary concept, Basis for a topology, Open and closed sets, Interior and closure of sets, Neighborhood of a point, Limits points, Boundary of a set, Subspace topology, Relative topology.	**8 Hours**
Unit-3:	**Continuous Functions:** Continuity, Sequentially continuous, Homeomorphism, Open and closed maps, Uniform continuity, Product invariant.	**8 Hours**
Unit-4:	**Axioms:** T_0, T_1, T_2 space, Normal space, Hausdorff spaces, Regular spaces, T_3 Space, T_4 space, Tychnoff space, Tietz- Extention theorem, Uryshon Lemma.	**8 Hours**
Unit-5:	**Compactness:** Reducible, Compact set, Finite intersection property, Locally Compact, Totally bounded set, Compactness for metric space.	**8 Hours**
Text Books:	**1.** James R. Munkres, Topology, Pearson Education Pvt. Ltd.	
Reference Books:	**1.** G.F. Simmons, Introduction to Topology and Mordern Analysis. **2.** K. D. Joshi, Introduction to General Topology, Wiley Eastern Limited. **3.** L. A. Steen and J. A. Seebach Jr, Counterexamples Topology, Holt Rinehart & Winston. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	https://www.youtube.com/watch?v=1wyOoLUjUeI https://www.youtube.com/watch?v=mZWP75DwItY&list=PLZSrM0Ajr9iTNKLXw0pZNOGvjJuwDKWlS	

Course Code: MAT215	**M.Sc. Mathematics- Semester-II** **Operation Research**	**L-4 T-0 P-1 C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the Mathematical formulation of optimization problems (linear and non-linear both) and their various solution techniques.	
CO2.	**Understanding** the mathematical formulation of inventory control problems and can find their optimality condition.	
CO3.	**Understanding** the concept of job sequencing and can find the various characteristics in n jobs and m machines problem.	
CO4.	**Understanding** the basic characteristics of Poisson queue (M/M/1, M/M/C).	
CO5.	**Understanding** the Non linear programming problem and the concepts of Morkov process	
Course Content:		
Unit-1:	Introduction: Definition and scope of O.R., Different O.R. models, General methods for solving O.R. models, Linear programming and Simplex method with simple problems, Two-phase and Big-M methods, Duality.	**8 Hours**
Unit-2:	Inventory Management: Inventory control, Types of inventories, Cost associated with inventories, Factors affecting inventory control, Single item deterministic problems with and without shortages, Inventory control with price breaks.	**8 Hours**
Unit-3:	Sequencing Theory: Introduction, Processing with n-jobs and two machines, n-jobs and three machines, n-jobs and m- machines, Non-linear Programming: Convex sets and convex functions, Non linear Programming, Mathematical formulation, Global Minima & Local Minima of function, Lagrange Multipliers, Kuhn-Tucker Condition (Necessary and sufficient).	**8 Hours**
Unit-4:	Queuing Theory: Introduction, Characteristics of queuing systems, Poisson process and Exponential distribution; Classification of queues, Transient and steady states; Poisson queues (M/M/1, M/M/C).	**8 Hours**
Unit-5:	Markov Analysis: Introduction, Markov Process, State Transition Matrix, Transition Diagram, Construction of a State- Transition Matrix, n-Step Transition Probabilities, Steady State Conditions.	**8 Hours**
Text Books:	**1.** S. D. Sharma Operation Research, KedarNath Ram Nath.	
Reference Books:	**1.** P. K. Gupta, KantiSwarup& Man Mohan, Operation Research, Sultan Chand & Co. **2.** R. L. Ackoff and N.W. Sasieni, Fundamental of Operations Research, John Willy. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	**https://www.youtube.com/watch?v=i9aScY7WrOg** **https://www.youtube.com/watch?v=iEcWPWeNqd0**	

Course Code: MGP211	M.Sc. Mathematics- Semester-II **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd & IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal

Course Code: TMUPA-201	VAC (Value Added Course) M.Sc. Mathematics (Semester-II) **Progressive Algebra & Data Management**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying the concepts of modern mathematics Divisibility rule, Remainder Theorem, HCF /LCM in Number System.	
CO2.	Relating the rules of permutation and combination, Fundamental Principle of Counting to find the probability.	
CO3.	Applying calculative and arithmetical concepts of ratio, Average and Percentage to analyze and interpret data	
CO4.	Employing the concept of higher level reasoning in Clocks and Calendars, Set theory and Puzzle Problems.	
Course Content:		
Unit-1:	**Number theory** Classification of Numbers, Divisibility Rules, HCF and LCM, Factors, Cyclicity (Unit Digit and Last Two digit), Remainder Theorem,Highest Power of a Number in a Factorial, Number of trailing zeroes	**7 Hours**
Unit-2:	**Data interpretation** Data Interpretation Basics, Bar Chart, Line Chart, Tabular Chart, Pie Chart, DI tables with missing values	**4 Hours**
Unit-3:	**Permutations and combinations** Fundamental counting, and or, arrangements of digits, letters, people in row, identical objects, rank, geometrical arrangements, combination: - basic, handshakes, committee, selection of any number of objects, identical and distinct, grouping and distribution, de-arrangements	**4 Hours**
Unit-4:	**Probability** Introduction, Probability based on Dice and Coins, Conditional Probability, Bayes Theorem	**3 Hours**
Unit-5:	**Set theory** Introduction , Venn Diagrams basics, Venn Diagram – 3 sets, 4-Group Venn Diagrams	**3 Hours**
Unit-6:	**Problem Solving** Introduction, Puzzle based on 3 variable, Puzzle based on 4 variable	**5 Hours**
Unit-7:	**Clocks and calendars** Introduction , Angle between hands , Gain and loss of Clock, Interchange of hands, Introduction of Calendars, Leap Year , Ordinary Year, Company Specific Pattern	**4 Hours**
Reference Books:	• R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude • R2:-Quantitative Aptitude by R.S. Agrawal • R3:-M Tyra: Quicker Maths • R4:-Nishith K Sinha:- Quantitative Aptitude for CAT • R5:-Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com	

	• R6:-Logical Reasoning by Nishith K Sinha • R7:-Verbal and Non Verbal Reasoning by R.S. Agrawal *** Latest editions of all the suggested books are recommended.**	

Course Code: TMUPS-201	Value Added Course M.Sc. Mathematics- Semester-II **Managing Work and Others**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Communicating effectively in a variety of public and interpersonal settings.	
CO2.	Applying concepts of change management for growth and development by understanding inertia of change and mastering the Laws of Change.	
CO3.	Analyzing scenarios, synthesizing alternatives and thinking critically to negotiate, resolve conflicts and develop cordial interpersonal relationships.	
CO4.	Functioning in a team and enabling other people to act while encouraging growth and creating mutual respect and trust.	
CO5.	Handling difficult situations with grace, style, and professionalism.	
Course Content:		
Unit-1:	**Intrapersonal Skills:** Creativity and Innovation Understanding self and others (Johari window) Stress Management Managing Change for competitive success Handling feedback and criticism	**8 Hours**
Unit-2:	**Interpersonal Skills:** Conflict management Development of cordial interpersonal relations at all levels Negotiation Importance of working in teams in modern organisations Manners, etiquette and net etiquette	**12 Hours**
Unit-3:	**Interview Techniques:** Job Seeking Group discussion (GD) Personal Interview	**10 Hours**
Reference Books:	1. Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education 2. Burne, Eric, Games People Play (2010), Penguin UK 3. Carnegie, Dale, How to win friends and influence people (2004), RHUK 4. Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan 5. Steinburg, Scott, Nettiquette Essentials (2013), Lulu.com	

	6. https://www.hloom.com/resumes/creative-templates/ 7. https://www.mbauniverse.com/group-discussion/topic.php 8. https://www.indeed.com/career-advice/interviewing/job-interview-tips-how-to-make-a-great-impression *** Latest editions of all the suggested books are recommended.**	

Course Code: MAT311	**M.Sc. Mathematics- Semester-III** **Functional Analysis**	**L-4 T-1 P-0 C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of completeness for Linear Space.	
CO2.	**Understanding** the concepts of Hilbert space with related identities and inequalities.	
CO3.	**Understanding** of fundamental theorems for Normed and Banach Spaces.	
CO4.	**Applying** the concepts of open mapping theorem, the closed graph theorem and Weierstrass theorem on spaces.	
CO5.	**Applying** the concept of Queuing Theory.	
Course Content:		
Unit-1:	Normed linear spaces, Banach spaces, Examples and counter examples, Quotient space of normed linear spaces and its completeness; Equivalent norms.	**8 Hours**
Unit-2:	Reisz Lemma, Basic properties of finite dimensional normed linear spaces; Bounded linear transformations and normed linear spaces of bounded linear transformations; Uniform boundedness theorem and some of its applications.	**8 Hours**
Unit-3:	Dual spaces, weak convergence, open mapping and closed graph theorems; Hahn Banch theorem for real and complex linear spaces.	**8 Hours**
Unit-4:	Inner product spaces, Hilbert spaces–Orthonormal sets; Bessel's inequality, complete orthonormal sets and Perseval 's identity.	**8 Hours**
Unit-5:	Structure of Hilbert spaces, Projection theorem, Riesz representation theorem, Adjoint of and operator on Hilbert space, Self adjoint operators, Normal and Unitary operators. Projections.	**8 Hours**
Text Books:	**1. 1.** E. Kreyszig, Functional Analysis and its application, John Wiley and sons.	
Reference Books:	**1. 1.** G. Bachman & L. Narici, Functional Analysis Academic Press. **2.** H.C. Goffman and G. Fedrick, First course in Functional Analysis, Prentice Hall of India. **3.** B.V. Limaye, Functional Analysis, New Age International Limited. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference material	**https://www.youtube.com/watch?v=xKnymE2wfDM** **https://www.youtube.com/watch?v=jWkzBaJDSmY**	

Course Code: MAT312	**M.Sc. Mathematics- Semester-III** **Partial Differential Equations**	**L-4** **T-1** **P-0** **C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of partial differential equations, Heat & Wave equation.	
CO2.	**Applying** non- linear partial differential equations of first order.	
CO3.	**Applying** partial derivative equation techniques to solve the Fourier & Laplace transform.	
CO4.	**Applying** specific methods to solve Heat equation.	
CO5.	**Applying** relaxation & Bender-Schmidt method to solve the difference & elliptic equations.	
CO6.		
Course Content:		
Unit-1:	Examples of PDE, Classification, Transport Equation: Initial value Problem, Non-homogeneous Equation. Laplace's Equation: Fundamental Solution.	**8 Hours**
Unit-2:	Heat Equation: Fundamental Solution; Mean Value Formula, Properties of Solutions, Energy Methods. Wave Equation: Solution by Spherical Means, Energy Methods.	**8 Hours**
Unit-3:	Nonlinear First Order PDE-Complete Integrals, Hamilton –Jacobi Equations (Calculus of Variations, Hamilton's ODE, Legendre Transform, Weak Solutions), Conservation Laws (Lax-Oleinik formula, Weak Solutions).	**8 Hours**
Unit-4:	Representation of Solutions-Separation of Variables, Similarity Solutions (Plane and Travelling Waves, Solitons, Similarity Linder Scaling), Hopf-Cole Transform.	**8 Hours**
Unit-5:	Deriving Difference Equations, Elliptic Equations: Solution of Laplace's equation, Leibmann's method, relaxation method, Bender-Schmidt method.	**8 Hours**
Text Books:	**1.** L.C. Evans, Partial Differential equations, Graduate Studies in Mathematics. Volume 19, AMS.	
Reference Books:	**1.** W. E. William, Partial Differential equations, Clarendon press-oxford. **2.** E. T. Copson, Partial differential equations, Cambridge university press. **3.** I.N. Sneddon, Elements of partial differential equations, Mc-Graw Hill book company. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	• https://www.youtube.com/watch?v=hbRTijWZox8 • https://www.youtube.com/watch?v=NOLW6FcpQBU • https://www.youtube.com/watch?v=Zr8SHbCdwXU • https://www.youtube.com/watch?v=-D4GDdxJrpg	

Course Code: MHM320	M.Sc. Mathematics- Semester-III **Human Values & Professional Ethics**	L-3 T-0 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the importance of value education in life and method of self-exploration.	
CO2.	**Understanding** 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration.	
CO3.	**Applying** right understanding about relationship and physical facilities.	
CO4.	**Analysing** harmony in myself, harmony in the family and society, harmony in the nature and existence.	
CO5.	**Evaluating** human conduct on ethical basis.	
Course Content:		
Unit-1:	Understanding of Morals, Values and Ethics; Introduction to Value Education- need for Value Education. Self- Exploration– content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration. Continuous Happiness and Prosperity- basic Human Aspirations. Gender Issues: Gender Discrimination and Gender Bias (home & office), Gender issues in human values, morality and ethics.	**8 Hours**
Unit-2:	Conflicts of Interest: Conflicts between Business Demands and Professional Ethics. Social and Ethical Responsibilities of Technologists. Ethical Issues at Workplace: Discrimination, Cybercrime, Plagiarism, Sexual Misconduct, Fraudulent Use of Institutional Resources. Intellectual Property Rights and its uses. Whistle blowing and beyond, Case study.	**8 Hours**
Unit-3:	Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman and other salient values in relationship.	**8 Hours**
Unit-4:	Understanding Harmony in the Nature and Existence – Whole existence as Co-existence. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Coexistence (Sah-astitva) of mutually interacting units in all pervasive space. Holistic perception of harmony at all levels of existence.	**8 Hours**
Unit-5:	Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Competence in professional ethics:	**8 Hours**

	a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems c) Ability to identify and develop appropriate technologies and management patterns for above production systems.	
Text Book:	**1.** R R Gaur, R Sangal, G P Bagaria, A Foundation Course in Value Education.	
Reference Books:	**1.** Ivan Illich, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA 2. E.F. Schumacher, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain. **2.** A Nagraj, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak. **3.** Sussan George, How the Other Half Dies, Penguin Press. Reprinted. **4.** PL Dhar, RR Gaur, Science and Humanism, Commonwealth Purblishers. **5.** A.N. Tripathy, Human Values, New Age International Publishers. **6.** E G Seebauer & Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	https://www.youtube.com/watch?v=Cnw1nK3K5qk https://www.youtube.com/watch?v=hTTCMrQyF8E	

Course Code: MAT392	M.Sc. Mathematics- Semester-III **Industrial Training & Presentation**	L-0 T-0 P-12 C-6
Course Procedure:		
	Students will have to undergo industrial training of six weeks in any industry or reputed organization after the II semester examination in summer. The evaluation of this training shall be included in the III semester evaluation. The student will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the II semester and shall be the nodal officer for coordination of the training. Students will prepare an exhaustive technical report of the training during the III semester which will be duly signed by the officer under whom training was undertaken in the industry/ organization. The covering format shall be signed by the concerned office in-charge of the training in the industry. The officer-in-charge of the trainee would also give his rating of the student in the standard University format in a sealed envelope to the Director/Principal of the college. The student at the end of the III semester will present his report about the training before a committee constituted by the Director/Principal of the College which would comprise of at least three members comprising of the Department Coordinator, Class Coordinator and a nominee of the Director/Principal. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Director/Principal. The marks by the external examiner would be based on the report submitted by the student which shall be evaluated by the external examiner and cross examination done of the student concerned. Not more than three students would form a group for such industrial training/ project submission.	
	The marking shall be as follows.	
Internal: **50 marks**	By the Faculty Guide – 25 marks. By Committee appointed by the Director/Principal – 25 marks.	
External: **50 marks**	By Officer-in-charge trainee in industry – 25 marks. By External examiner appointed by the University – 25 marks	
	Technical report will consist five chapter as per given format:	
Chapter 1:	Brief about organization	
Chapter 2:	Detail of business carried out by organization	
Chapter 3:	Specific contribution during the industrial training (not more than 500 words)	
Chapter 4:	Learning during the industrial training (not more than 200 words)	
Chapter 5:	Conclusion	

Course Code: MGP311	M.Sc. Mathematics- Semester-III **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd & IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal

Course Code: MAT314	**Discipline Specific Elective Course-I** **M.Sc. Mathematics- Semester-III** **Graph Theory**	**L-4** **T-1** **P-0** **C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of graphs, types of graphs and operations on graphs.	
CO2.	**Understanding** the concepts of tree, types of tree, cut-set and connectivity with network flow.	
CO3.	**Understanding** the concepts of planer graph, geometric dual, thickness and crossings.	
CO4.	**Understanding** the concepts of matrix representation of graphs, Chromatic number and the Four-Color Problem.	
CO5.	**Applying** the concepts of shortest path algorithm to solve the traveling salesman problem.	
Course Content:		
Unit-1:	Graph; Applications of Graph; Finite and Infinite Graphs; Null Graph; Incidence and Degree; Isolated Vertex; Pendant Vertex; Isomorphism; Sub graphs; Walks; Paths; Circuits; Connected Graphs, Disconnected Graphs and Components.	**8 Hours**
Unit-2:	Euler's Graph; Operations on Graphs; Hamiltonian Paths and Circuits; Shortest Path Algorithms; The Traveling Salesman Problem**;** Dijkastra's Algorithm; Fleury's Algorithm	**8 Hours**
Unit-3:	Trees; Properties of Trees; Pendant Vertices in a Tree; Distance and Centers in a Tree; Rooted and Binary Trees, On Counting Trees; Spanning Trees; Fundamental Circuits; Finding All Spanning Trees of a Graph; Spanning Trees in a Weighted Graph; Cut-Sets; Some Properties of a Cut-Set; Fundamental Circuits and Cut-Sets, Connectivity and Separability; Network Flows.	**8 Hours**
Unit-4:	Combinatorial and Geometric Graphs; Planar Graphs; Kuratowski's Two Graphs; Different, Detection of Planarity; Geometric Dual; Combinatorial Dual; Thickness and Crossings; Vectors and Vector Space; Associated with a Graph.	**8 Hours**
Unit-5:	Matrix representation of graphs; Incidence matrix; Sub matrix of $A(G)$; Circuit matrix, Fundamental circuit matrix and Rank of B; Cut-set matrix; Path matrix; Adjacency Matrix; Adjacency Matrix; Chromatic Number; Chromatic Partitioning; Chromatic Polynomial; Matching Coverings, The Four-Color Problem.	**8 Hours**
Text Books:	**1.** Narsingh Deo; Graph Theory; Prentice-Hall, Inc.	
Reference Books:	**1.** J.A. Bondy U.S.R. Murty; Graph Theory, Springer. **2.** Reinhard Diestel; Graph Theory, Springer. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference material	https://www.youtube.com/watch?v=2DydHpOhSnE https://www.youtube.com/watch?v=i6kjKKpBo78	

Course Code: MSC014	**Discipline Specific Elective Course-I** **M.Sc. Mathematics- Semester-III** **Database Management System**	**L-4 T-1 P-0 C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concept of Database Management System	
CO2.	**Applying** the commercial relational database system (Oracle).	
CO3.	**Applying** the relational algebra expressions for queries.	
CO4.	**Applying** the basic database storage structures and access techniques: file and page organizations, indexing methods including B-tree, and hashing.	
CO5.	**Analyzing** the issues of transaction processing and concurrency control.	
Course Content:		
Unit-1:	**Introduction:** Scope and purpose of database system, view of data, relational databases, database architecture, transaction management, database system Vs file system, Database system concept and architecture, data definitions language, DML. **Data Models**: The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction	**8 Hours**
Unit-2:	**Database design and ER Model**: overview, ER-Model, Constraints, ER-Diagrams, ERD Issues, weak entity etc, Codd's rules, Relational Schemas, Introduction to UML, Relational database model: Logical view of data, keys, integrity rules. Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF)	**8 Hours**
Unit-3:	**Relational data Model and Language**: Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, Relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra, Computational capabilities, constraints, Views. **Introduction on SQL**: Characteristics of SQL, advantage of SQL. SQL data type and literals. Types of SQL commands. SQL operators and their procedure. Tables, views and indexes. Queries and sub queries. Aggregate functions. Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, and Procedures in SQL/PL SQL.	**8 Hours**
Unit-4:	Usage of Oracle: **1.** Installing oracle **2.** Creating Entity-Relationship Diagram using case tools. **3.** Writing SQL statements Using ORACLE **4.** MYSQL: a) Writing basic SQL SELECT statements. b) Restricting and sorting data. c) Displaying data from multiple tables.	**8 Hours**

	d) Aggregating data using group function. e) Manipulating data. f) Creating and managing tables. **5.** Normalization in ORACLE. **6.** Creating cursor in oracle. **7.** Creating procedure and functions in oracle. **8.** Creating packages and triggers in oracle.	
Unit-5:	Transaction management: ACID properties, serializability and concurrency control Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management.	**8 Hours**
Text Books:	**1.** Elmasri, R., Navathe, S., Fundamentals of Database Systems, Addison-Wesley. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	https://www.youtube.com/watch?v=wkOD6mbXc2M https://www.youtube.com/watch?v=siKBrudOYwo	

Course Code: MAT315	**Discipline Specific Elective Course-II** **M.Sc. Mathematics- Semester-III** **Probability & Mathematical Statistics**	**L-4** **T-1** **P-0** **C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concept of the probability, addition law of probability, multiplication law of probability and Bayes theorem with its applications.	
CO2.	**Understanding** the basic tools of sampling, probability mass function and probability density function.	
CO3.	**Applying** the moment generating function and mathematical expectation find out the mean & variance of the function.	
CO4.	**Applying** the different properties of estimator, estimate consistency, unbaisedness and efficiency.	
CO5.	**Analyzing** the M.G.F, C.F and P.D.F of the discrete distribution and continuous distribution, find out its mean and variance.	
Course Content:		
Unit-1:	Probability: Introduction, notion of probability, outcomes , events and algebra of events, Kinds of Probability: classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events.	**8 Hours**
Unit-2:	Random variable: discrete and continuous random variables, joint probability mass function, marginal distribution function, joint density function, Mathematical expectation- Definition of Mathematical Expectation, Moments, Moment generating function.	**8 Hours**
Unit-3:	Discrete Probability Distributions: Binomial distribution: M.G.F, C.F, P.G.F and Recurrence relation, Poisson distribution: Poisson M.G.F C.F, P.G.F, binomial dist tends to passion distribution ; Negative Binomial-MGF, Poisson process as a limiting case of negative binomial distribution.	**8 Hours**
Unit-4:	Continuous probability distributions: Uuniform: Momemts, M.G.F, Characteristic function, Beta distribution of first kind and Second kind : M.G.F, C.F its mean and variance, Gamma-distribution: MGF, C.F its mean and variance.	**8 Hours**
Unit-5:	Theory of estimation, characteristics of estimation- Consistensy, Unbiasedness, Efficiency and Sufficiency, Invariance Property of Consistent Estimators, Sufficient Conditions for Consistency, Efficient Estimators, Most Efficient Estimator, Sufficiency.	**8 Hours**
Text Books:	**1.** Robert V. Hogg and Allen T. Craig, Introduction to Mathematical Statistics, Macmillan Publishing Co. Inc.	
Reference Books:	**1.** Feller, W: Introduction to Probability and its Applications, Wiley Eastem Pvt. Ltd. **2.** K.L.Chung, A course in Probability, Academic Press. **3.** R.Durrett, Probability Theory and Examples, Duxbury Press.	

Additional electronic reference material	1. https://www.youtube.com/watch?v=uq5w2aFwNhE&list=PLLgJVrtHe9RoB9LIZPuwv_zZNmGniGrai 2. https://www.youtube.com/watch?v=IfExtv06q_M 3. https://www.youtube.com/watch?v=fs4KpMkEUQE	

Course Code: MSC013	**Discipline Specific Elective Course-II** **M.Sc. Mathematics- Semester-III** **Statistical Techniques in Data Mining**	**L-4** **T-1** **P-0** **C-5**
Course Outcomes:	On completion of the course, the students will be :	
CO1.	**Understanding** the concepts of correlation and regression analysis using by variable.	
CO2.	**Understanding** the tools necessary for data mining.	
CO3.	**Applying** test according to data in variable field.	
CO4.	**Analyzing** the relevant properties of data.	
CO5.	**Analyzing** the builds models to detect patterns and relationship in data.	
Course Content:		
Unit-1:	**Introduction:** Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. **Data Preprocessing:** Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.	8 Hours
Unit-2:	**Mining Frequent Patterns, Associations and Correlations:** Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.	8 Hours
Unit-3:	**Classification and Prediction:** Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods.	8 Hours
Unit-4:	**Cluster Analysis Introduction :**Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid- Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint Based Cluster Analysis, Outlier Analysis - Mining Streams, Time Series and Sequence	8 Hours
Unit-5:	**Mining Object, Spatial, Multimedia, Text and Web Data:** Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web. **Applications and Trends in Data Mining:** Data Mining Applications, Data Mining System Products and Research Prototypes, Additional Themes on Data Mining and Social Impacts of Data Mining.	8 Hours

Text Books:	**1.** Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers.	
Reference Books:	**1.** Data Warehousing in the Real World – Sam Aanhory & Dennis Murray Pearson Asia. **2.** Data Warehousing Fundamentals – Paulraj Ponnaiah Wiley student Edition. **3.** The Data Warehouse Life cycle Tool kit – Ralph Kimball Wiley student edition. **4.** Building the Data Warehouse By William H Inmon, John Wiley & Sons Inc. **5.** Data Mining Introductory and advanced topics –Margaret H Dunham, Pearson education. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference material	https://www.youtube.com/watch?v=3imSHVySLRc https://www.youtube.com/watch?v=4Q0kUCvhmAk	

Course Code: MAT411	**M.Sc. Mathematics- Semester-IV** **Number Theory**	**L-4** **T-1** **P-0** **C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of division algorithm, greatest common divisor, least common multiple and Bracket functions.	
CO2.	**Understanding** the concept of congruence and solution approach of the Diophantine equations.	
CO3.	**Understanding** the concept of number theoretic functions and their applications to cryptography.	
CO4.	**Understanding** the three milestone theorems on number theory: Chinese remainder theorem, Fermat theorem, Wilson Theorem and their applications.	
CO5.	**Analyzing** the primitive roots and learn the solution approach of solving quadratic congruence.	
Course Content:		
Unit-1:	The Division Algorithm, the gcd, The Euclidean Algorithm, Diophantine equation ax + by = c; The fundamental theorem of arithmetic; The Sieve of Eratosthenes; The Goldbach conjecture.	**8 Hours**
Unit-2:	Theory of Congruences – Basic properties of Consequence; Linear Congruences, Chinese remainder theorem, Fermat's Theorem, Wilson's Theorem. Statement of Prime number theorem. Some primality testing.	**8 Hours**
Unit-3:	Number-Theoretic Functions – The functions T and Sigma; The mobius inversion formula; The Greatest integer function, Euler's Phi function – Euler Theorem, Properties of the Phi-function, Applications to Cryptography.	**8 Hours**
Unit-4:	The order of an integer modulo n, Primitive roots for primes; The theory of indices, Euler's criterion, Legendre's symbol and its properties; Quadratic reciprocity, Quadratic congruences with composite moduli.	**8 Hours**
Unit-5:	Perfect Numbers; Representation of integers as sum of two squares and sum of more than two squares.	**8 Hours**
Text Books:	**1.** Davis M. Burton, Elementary Number Theory, USB.	
Reference Books:	**1.** U. Dudley, Elementary Number Theory, Freeman & Co. **2.** George Andrews, Number Theory, Courier Dover Publications. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference material	https://www.youtube.com/watch?v=nBHa_5Oqi_Q https://www.youtube.com/watch?v=9l5HCbMye_8	

Course Code: MAT412	**M.Sc. Mathematics- Semester-IV** **Advanced Discrete Mathematics**	**L-4** **T-1** **P-0** **C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of propositions, logical implication and Boolean algebra.	
CO2.	**Understanding** the concepts of isomorphism of semi groups and monoids.	
CO3.	**Understanding** the concepts of poset, lattice and types of lattice.	
CO4.	**Understanding** the concepts of language, regular set and finite state machine.	
CO5.	**Applying** the concepts of Karnaugh map to convert the Boolean expressions in Normal forms.	
Course Content:		
Unit-1:	Propositional Calculus: Proposition and logical operations; Proposition and truth tables; Tautologies & contradiction; Logical equivalence; Conditional & Bi-conditional statements; Logical implication; Propositional functions & quantifiers. Semi groups & Monoids: Definitions and examples of semi groups and monoids; Isomorphism & homomorphism of semi groups and monoids.	**8 Hours**
Unit-2:	Partially ordered set; Hasse diagram; External element of poset; Lattices as algebraic system; Sub lattices, Isomorphic lattices, Bounded lattices; Complete, Compliment, Complemented lattices, Modular lattices, Penthogonal lattices, Pentagonal	**8 Hours**
Unit-3:	Boolean algebra: Definition, Principle of duality, Basic Theorems, Sub algebra, Isomorphic; Boolean algebra as lattices; Boolean functions and min-terms; Disjunctive normal form; Complete disjunctive normal form; Conjugate normal form.	**8 Hours**
Unit-4:	Language & Grammar and their types: Regular expressions and Regular sets; Regular language, Finite state Automata	**8 Hours**
Unit-5:	Finite state Machine, Semi-Machines and languages; Application of Logic Circuit: Sum-of products form for Boolean algebra; Minimal Boolean expressions, Prime implicants, Logic and Circuits; Boolean functions, Karnaugh map.	**8 Hours**
Text Books:	**1.** B. Colman, R.C. Busby & S. Ross, Discrete Mathematical Structures, Prentice Hall of India Pvt. Ltd.	
Reference Books:	**1.** Susanna S. Epp, Discrete Mathematics with Applications, Thomson Learning TM. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	https://www.youtube.com/watch?v=itrXYg41-V0 https://www.youtube.com/watch?v=3LfLUAECJfM	

Course Code: MAT461	**M.Sc. Mathematics- Semester-IV** **MATLAB Programming**	**L-0** **T-1** **P-2** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** simple program modules to implement single numerical methods and algorithms.	
CO2.	**Applying** to use basic flow controls (if-else, for, while).	
CO3.	**Applying** Test program output for accuracy using hand calculations and debugging techniques	
CO4.	**Applying** multiple program modules into larger program packages	
CO5.	**Analyzing** the generate plots and export this for use in reports and presentations.	
Course Content:		
Unit-1:	**MATLAB Basics:** MATLAB environment, Menus and the toolbar, Basic computer programming, variables and constants, operators and simple calculations, formulas and functions, MATLAB toolboxes, use of MATLAB help, Debugging MATLAB codes**.**	**8 Hours**
Unit-2:	**Matrices & Vectors**: Matrix representation, Resizing and Reshaping Matrices, General Operating on Matrices, Multidimensional Arrays and sorting of arrays, Matrices in the MATLAB Environment, Matrix Operations and Function in MATLAB, Matrix Division, Eigen values and vectors, Special matrices.	**8 Hours**
Unit-3:	**Loop and Selection Statements:** Functions and Scripts, break statement, continue statement, end statement, for statement, for nested loop statement, if/else if/else statement, while statement - nested while statement.	**8 Hours**
Unit-4:	**Plotting And I/O:** Plot functions, X-Y Plotting, plotyy, surf, mesh, contour, pie chart, bar diagram, 3D plots, handle graphics and plot properties, saving and printing plots, File input/output, writing and reading spreadsheet files, Using MAT files for variables, Simple programs.	**8 Hours**
Unit-5:	**Toolboxes:** Curve fitting toolbox: Curve Fitting Objects and Methods. Signal Processing toolbox: Filter Design Process Overview, Basic Filter Design Process. Symbolic math toolbox: Symbolic Objects, Creating and Performing Symbolic Computations.	**8 Hours**
Text Books:	**1.** Ross L. Spencer and Michael Ware, Introduction to MATLAB, Brigham Young University.	
Reference Books:	**1.** Suresh Chandra, Applications of Numerical Techniques with C, Narosa. **2.** Vinay K. Lngle and John G. Proakis, Digital Signal Processing Using Matlab, PWS Publishing Company. **3.** P.B. Zbar and A.P. Malvino, Basic Electronics: A Text-Lab Manual, Tata Mc-Graw Hill. ***Latest editions of all the suggested books are recommended.**	

Experiments:

Experiments:	Note: Minimum 15 experiments should be performed:	
Experiment-1:	To find the Local Environment for MATLAB programming.	
Experiment-2:	Enter the m*n order matrix.	
Experiment-3:	Find the matrix transpose.	
Experiment-4:	Find the inverse of matrix.	
Experiment-5:	Find the addition, subtraction & multiplication of matrix.	
Experiment-6:	If $V_1 = 5v$, $V_2 = 6v$, $Z_{11}=2$, $Z_{12}=1$, $Z_{21}=3$ $Z_{22}=4$, get the value of I_1 and I_2?	
Experiment-7:	If A1 = [2 7 6 8 9 10] and B1 = [6 4 3 2 3 4], Find a) C1 = A1.*B1 b) D1 = A1./B1	
Experiment-8:	If r1 = [7 3 5] and s1 = [2 4 3], get a) q1 = r1.^s1 b) q2 = r1.^2	
Experiment-9:	State if the following statements are true or false, a) If a MATLAB statement ends with a semicolon (;) MATLAB evaluates the statement but suppresses the display of the results. b) The end of each row in entering a matrix, is indicated by a semicolon (;) c) MATLAB is case sensitive in naming variables only.	
Experiment-10:	Enter the following matrix, **A = 1 3 4 2** **2 0 1 6** **4 1 2 7** **0 3 6 4** a. Get the diagonal of the matrix A b. Get the sum of each column in the matrix A c. Get the sum of each row in the matrix A d. Get the sum of all elements in the matrix A e. Add 2 to the element in the 2nd row and 3rd column	
Experiment-11:	Enter the following complex number, z = 2-j3 then a. Get the real and the imaginary parts of z b. Get the magnitude and the phase angle of z c. If y = 3+j5, calculate the following: y+z, y-z, y×z	
Experiment-12:	If w = [1+j 5-2*j; 3+2*j 4+3*j] a. Get the conjugate transpose b. Get the point transpose c. Type the elements of 2nd row only	
Experiment-13:	Reshape matrix.	
Experiment-14:	Eliminate Rows of matrix.	
Experiment-15:	Sorting a matrix	
Experiment-16:	Plot, xlabel, ylabel, title, and axis commands;	
Experiment-17:	Find difference between plot, semilogy, semilogx, logog commands	
Experiment-18:	Bar plot, Pie chart, 3D plots command	
Experiment-19:	Creating and performing symbolic computations.	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MAT492	M.Sc. Mathematics- Semester-IV **Project**	L-0 T-0 P-18 C-09

For students to enter into preliminary research field both in theory and experiment the concept of Project has been introduced in the final Semester. In the Project, the student will explore new developments from the books and journals, collecting literature / data and write a Dissertation based on his / her work and studies. The Project Work can also be based on experimental work in industries / research laboratories.

Selection of Topic:

1. Students will make project which should be preferably a working of third thoughts based on their subject.
2. The student will be assigned a faculty guide who will be the supervisor of the students. The faculty would be identified at the end of the III semester.
3. The assessment of performance of the students should be made at least twice in the semester. Internal assessment shall be for 50 marks. The students shall present the final project live using overhead projector PowerPoint presentation on LCD to the internal committee and the external examiner.
4. The evaluation committee shall consist of faculty members constituted by the college which would be comprised of at least three members comprising of the department Coordinator's Class Coordinator and a nominee of the Director/Principal. The students guide would be special in invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each members of the committee.

The Marking shall be as follows.

Internal: 50 marks

By the Faculty Guide – 25 marks

By Committee appointed by the Director/Principal – 25 marks

External: 50 marks

By External examiner by the University – 50

Note: Project will be prepared as per approved project template which included the entire guidelines & format related project.

EVALUATION SHEET

(To be filled by the GUIDE & Internal Examiners only)

Name of Candidate:
Roll No:

Class and Section:

Please evaluate out of five marks each.

S. No.	Details	Marks (5) Guide	Marks (5) Int. Exam. 1	Marks (5) Int. Exam. 2
1.	Objective Identified &Understood			
2.	Literature Review / Background Work (Coverage, Organization, Critical Review)			
3.	Discussion/Conclusions (Clarity, Exhaustive)			
4.	Slides/Presentation Submitted (Readable, Adequate)			
5.	Frequency Of Interaction (Timely Submission, Interest Shown, Depth, Attitude)			
	Total (Out of 25)			
	Average out of 50			

Signature: Signature: Signature:
Date: Date: Date:

EVALUATION SHEET FOR EXTERNAL EXAMINER

(To be filled by the External Examiner only)

Name of Candidate:

Roll No:

I. For use by **External Examiner ONLY**

S. No.	Details	Marks (10) each
1.	Objective Identified & Understood	
2.	Literature Review / Background Work (Coverage, Organization, Critical Review)	
3.	Discussion/Conclusions (Clarity, Exhaustive)	
4.	Power Point Presentation (Clear, Structured)	
5.	Slides (Readable, Adequate)	
	Total (Out of 50)	

Signature:

Date:

Course Code: MGP411	M.Sc. Mathematics- Semester-IV **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd & IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal

Course Code: **MAT414**	**Discipline Specific Elective Course-III** **M.Sc. Mathematics- Semester-IV** **Fuzzy Sets & its application**	**L-4** **T-1** **P-0** **C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** basic knowledge of fuzzy sets and fuzzy logic.	
CO2.	**Applying** fuzzy inferences.	
CO3.	**Applying** fuzzy information in decision making.	
CO4.	**Applying** the theory of possibility on the basis of evidences.	
CO5.	**Analyzing** the fuzzy relations on fuzzy sets.	
Course Content:		
Unit-1:	Crisp Sets, Fuzzy Sets (basic types), Fuzzy Sets (basic concepts); Representation of fuzzy sets; Decompositions theorems; Extension principle for fuzzy sets.	**8 Hours**
Unit-2:	Operations on fuzzy sets (Fuzzy compliment, Intersection and union); Combinations of operations.	**8 Hours**
Unit-3:	Fuzzy numbers, Linguistic variables; Arithmetic operations on fuzzy numbers; Lattice of fuzzy numbers, Fuzzy equations.	**8 Hours**
Unit-4:	Crisp and fuzzy relations; Projections; Binary fuzzy relations; Binary relations on a single set; Fuzzy equivalence relations; Fuzzy compatibility relations; Fuzzy ordering relations; Fuzzy morphism; Sup-i compositions of binary fuzzy relations.	**8 Hours**
Unit-5:	Fuzzy relation equations; Fuzzy logic; Fuzzy decision making**;** Fuzzy linear programming; Linear Regression with fuzzy parameters; Fuzzy regression with fuzzy data.	**8 Hours**
Text Books:	**1.** George J. Klier and Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India.	
Reference Books:	**1.** Kaufmann, A. and Gupta, M.M. Fuzzy Mathematical Models in Engineering and Management Science, Elsevier Science Inc. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference material	https://www.youtube.com/watch?v=dKSVecDUUI8 https://www.youtube.com/watch?v=PIvxnE2S_tE	

Course Code: MAT415	**Discipline Specific Elective Course-III** **M.Sc. Mathematics- Semester-IV** **Calculus of variations and Integral Equation**	**L-4** **T-1** **P-0** **C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of variationally problems.	
CO2.	**Applying** the numeric method on various integral equations.	
CO3.	**Applying** the method of Successive Approximations & Fredholm Theory.	
CO4.	**Analyzing** isoperimetric problems.	
CO5.	**Analyzing** the decomposition method.	
Course Content:		
Unit-1:	**Variationally Problems with Moving Boundaries:** The concept of Variation and its properties – Euler's equation – Variationally problems for functional – Functionals dependent on higher order derivatives – Functions of several independent variables – Some applications to problems of mechanics.	**8 Hours**
Unit-2:	**Variationally Problems With Moving Boundaries (Contd.)** Movable boundary for a functional dependent on two functions – One sided variations – Reflection and Refraction of extremals – Diffraction of light rays.	**8 Hours**
Unit-3:	**Integral Equations** Introduction – Definition – Regularity conditions – Special kinds of Kernals – Eigen values and eigen functions – Convolution integral – Reduction to a system of algebraic equations – Examples – Fredholm alternative – Examples – An approximation method.	**8 Hours**
Unit-4:	**Method of Successive Approximations and Fredholm Theory:** Method of successive approximations – Iterative scheme – Examples – Volterra integral equations – Examples – Some results about the resolvent kernel – The method of solution of Fredholm equation – Fredholm first theorem – Examples.	**8 Hours**
Unit-5:	**Applications to Ordinary Differential Equations** Initial value problems – Boundary value problems – Examples – Singular integral equations – The Abel integral equations - Examples.	**8 Hours**
Text Books:	**1.** A. S. Gupta, Calculus of Variations with Applications, PHI, New Delhi.	
Reference Books:	**1.** M. D. Raisinghania, Integral Equations and Boundary Value Problems, S. Chand & Co., New Delhi. **2.** Sudir K. Pundir and Rimple Pundir, Integral Equations and Boundary Value Problems, Pragati Prakasam. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference material	https://www.youtube.com/watch?v=H9L3M67C5r0 https://www.youtube.com/watch?v=J8YFK0wnW_g	