UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE' UNIVERSITY)
(Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION

(24/January/Adp./102)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the Syllabi and Courses of Studies in the subject of **Mathematics** of Semester **Vth, VIth,VIIth and VIIIth for Four Year Under Graduate Programme (FYUGP)** under the **Choice Based Credit System** as per **NEP-2020 (as given in the annexure)** for the examinations to be held in the years as per the details given below:

Subject	**Semester**	**For the examinations to be held in the year**
Mathematics	Semester-V	December 2024, 2025 and 2026
	Semester-VI	May 2025, 2026 and 2027
	Semester-VII	December 2025, 2026 and 2027
	Semester-VIII	May 2026, 2027 and 2028

The Syllabi of the courses are also available on the University website: www.jammuuniversity.ac.

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/24/13792-848
Dated: 1/2/2024.

Copy for information and necessary action to:

1. Dean Faculty of Mathematical Science
2. HOD/Convener, Board of Studies **Mathematics**
3. Sr. P.A.to the Controller of Examinations
4. All members of the Board of Studies
5. Confidential Assistant to the Controller of Examinations
6. Director, Computer Centre, University of Jammu
7. Deputy Registrar/Asstt. Registrar (Conf. /Exams. UG)
8. Incharge University Website for necessary action please

Sumitra Sharma 1/2/24

Deputy Registrar (Academic)

31/1/24 Today 31/01/24

Semester V

Semester V (MATHEMATICS)

4 Credits Courses

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
				4=3Th+1T	Theory		Tutorial		100
1.	Major	UMJMAT- 501	Abstract Algebra-II	4	Mid Semester Examination: 15 Marks	End Semester Examination: 60 Marks	Continuous Assessment: 10 Marks	Final Exam: 15 Marks	
2.	Major	UMJMAT- 502	Linear Algebra-I	4					
3.	Major	UMJMAT- 503	Probability and Statistics	4					
4.	Minor	UMIMAT- 504	Probability Theory	4					

2 Credits Courses

S. No.	Course Type	Course No.	Course Title	Credits	Marks		Total Marks
					Theory		50
1.	Major	UMJMAT- 505	Set Theory	2	Mid Semester Examination: 10 Marks	End Semester Examination: 40 Marks	
2.	SE	USEMAT-506	Summer Internship*	2	Presentation of the Report: 10 Marks	Project Report: 40 Marks	

*Summer internship is to provide professional training to students in an academic institute, technical institute, industry (Public/Private Sector), as a research assistant, social media content creator, Business Analyst or any other professional education decided by the Principal of the concerned college. The candidate has to submit a report after the completion of the internship.

Semester VI

Semester VI (MATHEMATICS)

4 Credits Courses

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
				4=3Th+1T	Theory		Tutorial		100
1.	Major	UMJMAT- 601	Linear Algebra-II	4	Mid Semester Examination: 15 Marks	End Semester Examination: 60 Marks	Continuous Assessment: 10 Marks	Final Exam: 15 Marks	
2.	Major	UMJMAT- 602	Numerical Methods	4					
3.	Major	UMJMAT- 603	Basic Complex Analysis	4					
4.	Major	UMJMAT- 604	Graph Theory	4					
5.	Major	UMJMAT 605	Abstract Algebra-III	4					
6.	Minor	UMIMAT- 606	Numerical Analysis	4					

- Students are required to opt any four major courses out of five given above.

Semester VII

Semester VII (MATHEMATICS)

4 Credits Courses

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
				4=3Th+1T	Theory		Tutorial		100
1.	Major	UMJMAT- 701	Topology-I	4	Mid Semester Examination: 15 Marks	End Semester Examination: 60 Marks	Continuous Assessment: 10 Marks	Final Exam: 15 Marks	
2.	Major	UMJMAT- 702	Measure Theory	4					
3.	Major	UMJMAT- 703	Differential Geometry	4					
4.	Major	UMJMAT- 704	Complex Analysis	4					
5.	Major*	UMJMAT-705	Research Methodology	4					
6.	Major	UMJMAT-706	Theory of Optimization	4					
7.	Minor	UMIMAT- 707	Optimization Theory	4					

- Honor\Research Students are required to choose four major courses out of six given above however UMJMAT-705 is compulsory for students opting for Research.

Semester VIII

Semester VIII (MATHEMATICS)

(Honors)

4 Credits Courses

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
				4=3Th+1T	Theory		Tutorial		100
1.	Major	UMJMAT- 801	Commutative Algebra	4	Mid Semester Examination: 15 Marks	End Semester Examination: 60 Marks	Continuous Assessment: 10 Marks	Final Exam: 15 Marks	
2.	Major	UMJMAT- 802	Advance Complex Analysis	4					
3.	Major	UMJMAT-803	Functional Analysis	4					
4.	Major	UMJMAT-804	Cryptography	4					
5.	Major	UMJMAT- 805	Fluid Dynamics	4					
6.	Major	UMJMAT- 806	Topology-II	4					
7.	Minor	UMIMAT- 807	Partial Differential equation	4					

- The candidate has to opt any four major courses of credits 4 out of the six given above.

Research:

<table>
<tr><th>S. No.</th><th>Course Type</th><th>Course No.</th><th>Course Title</th><th>Credits</th><th colspan="4">Marks</th><th>Total Marks</th></tr>
<tr><td>1.</td><td>Major</td><td colspan="8">The candidate has to opt any one major course of credits 4 out of the six major courses.</td></tr>
<tr><td rowspan="2">2.</td><td rowspan="2">Minor</td><td rowspan="2">UMIMAT- 807</td><td rowspan="2">Partial Differential equation</td><td rowspan="2">4</td><td colspan="2">Theory</td><td colspan="2">Tutorial</td><td rowspan="2">100</td></tr>
<tr><td>Mid Semester Examination: 15 Marks</td><td>End Semester Examination: 60 Marks</td><td>Continuous Assessment: 10 Marks</td><td>Final Exam: 15 Marks</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td colspan="2">Dissertation (8-Credits)</td><td colspan="2">Viva (4-Credits)</td><td></td></tr>
<tr><td>3.</td><td>SE</td><td>USEMAT-808</td><td>Dissertation</td><td>12</td><td colspan="2">200</td><td colspan="2">100</td><td>300</td></tr>
</table>

Semester V

Semester V (MATHEMATICS)

4 Credits Courses

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
				4=3Th+1T	Theory		Tutorial		100
1.	Major	UMJMAT- 501	Abstract Algebra-II	4	Mid Semester Examination: 15 Marks	End Semester Examination: 60 Marks	Continuous Assessment: 10 Marks	Final Exam: 15 Marks	
2.	Major	UMJMAT- 502	Linear Algebra-I	4					
3.	Major	UMJMAT- 503	Probability and Statistics	4					
4.	Minor	UMIMAT- 504	Probability Theory	4					

2 Credits Courses

S. No.	Course Type	Course No.	Course Title	Credits	Marks		Total Marks
					Theory		50
1.	Major	UMJMAT- 505	Set Theory	2	Mid Semester Examination: 10 Marks	End Semester Examination: 40 Marks	
2.	SE	USEMAT-506	Summer Internship*	2	Presentation of the Report: 10 Marks	Project Report: 40 Marks	

*Summer internship is to provide professional training to students in an academic institute, technical institute, industry (Public/Private Sector), as a research assistant, social media content creator, Business Analyst or any other professional education decided by the Principal of the concerned college. The candidate has to submit a report after the completion of the internship.

University of Jammu

Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER V
(Examination to be held in December 2024, 2025, 2026)
Major Course

Course Code: UMJMAT-501
Course Title: Abstract Algebra-II
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course continues the study of abstract algebra and is focused mainly on group of automorphisms and permutation groups with some exploration of the fundamental concepts in ring theory such as ideals, quotient rings and integral domain.

Prerequisite of this course: The knowledge of Algebra-I (UMJMAT402) studied in Semester-IV.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Centre of group, centralizer of a group, $o(HK) = \frac{o(H)o(K)}{o(H\cap K)}$, for finite subgroups H and K of a group G, Euler $\phi-$ function, number of generators of a cyclic group of order n is $\phi(n)$, structure theorem for a cyclic group, Direct product of subgroups of a group, Examples and exercises based on these concepts.

Unit-II

Automorphism of a group, inner automorphism of a group, the number of automorphisms of a group of order n is $\phi(n)$, Group of all automorphisms of a group G, $A(G)$, the set of all inner automorphisms of a group G, $I(G)$ is subgroup of $A(G)$. Examples and exercises based on these concepts.

Course Code : UMJMAT – 501
Course Title : Abstract Algebra – II

Unit-III

Permutation group S_n, A_n the subgroup of S_n, $o(A_n) = \frac{n!}{2}$, transpositions, cycle of order r, signature of permutation, Cayley's theorem, Converse of Lagrange's theorem. Examples and exercises based on these concepts.

Unit-IV

Definition of Ring, division ring, subring, ideal, skew field, field, integral domain. Examples based on number system, matrices, polynomials, Gaussian integers. Ring homomorphism, Kernel and Image of ring homomorphism, isomorphism, First fundamental theorem of ring homomorphism. Idea of prime and maximal ideals of a ring. Examples and exercises based on these concepts.

Text Books:

1. *Topics in Algebra*, I. N. Herstein, John Wiley and Sons.

Reference Books:

1. *Modern Algebra*, Surjeet Singh and Qazi Zameeruddin, Vikas Publishing House Pvt. Ltd.
2. *Algebra*, Michael Artin, PHI Pvt. Ltd.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER V
(Examination to be held in December 2024, 2025, 2026)
Major Course

Course Code: UMJMAT-502
Course Title: Linear Algebra-I
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course aims to provide indepth knowledge of matrices, methods to solve system of linear equations and to study the fundamental notions of vector spaces such as linear dependence and independence, basis and dimension etc.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Linear equations: solutions of homogeneous and non-homogeneous linear equations, Determinant: definition and its properties viz $D(AB) = D(A)D(B)$, Cramer's Rule. Matrices: symmetric, skew-symmetric, Hermitian, skew-Hermitian, unitary and orthogonal, Rank of a matrix, Examples and exercises based on these concepts.

Unit-II

Similar matrices, characteristic polynomial, characteristic minimal polynomial, characteristic roots, charcteristic vectors, Diagonalization of a matrix, Cayley-Hamilton theorem, Examples and exercises based on these concepts.

Unit-III

Vector space, subspace of a vector space, quotient space, linear combination of vectors, linear span, linearly independent and linearly dependent vectors, examples and exercises based on these concepts.

Unit-IV

Basis and dimension of a vector space, Existence of a basis for finite dimensional vector space, Extension theorem, $\dim(V+W) = \dim V + \dim W - \dim(V \cap W)$ for V, W subspaces of a vector space U, $\dim(V/W) = \dim V - \dim W/$ Examples and exercises based on these concepts.

Course Code : UMJMAT – 502
Course Title : Linear Algebra – I

Text Books:

1. *University Algebra*, N. S. Gopalakrishnan, Fourth Edition, New Age International, Oct 2021.

Reference Books:

1. *Linear Algebra*, Kennneth Hoffman and Ray Kunz, PHI.
2. *Modern Algebra*, Surjeet Singh and Qazi Zameeruddin, Vikas Publishing House Pvt. Ltd.
3. *Algebra*, Michael Artin, PHI Pvt. Ltd.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER V
(Examination to be held in December 2024, 2025, 2026)
Major Course

Course Code: UMJMAT-503
Course Title: Probability and Statistics
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This aim of this course is to provides the basics of probability theory and study some standard distributions such as binomial distribution, Poisson distribution, normal distribution etc.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Sample Space, Probability Axioms, Real Random Variable, Cumulative Distribution Function, Probability Mass/ Density Function, Mathematical Expectations, Moments About Origin and Moments about Mean, Moment Generating Function. Examples and exercises based on these concepts.

Unit-II

Bernoulli, Binomial and Poisson Distribution. Mean, Mode, Variance, Moments and Moment Generating Functions of these Distributions, Recurrence relations of Binomial and Poisson Distributions. Examples and exercises based on these concepts.

Unit-III

Normal Distribution, Mean, Mode, Variance, Median and Moments about Mean of Normal Distribution, 95% Confidence Interval for Mean of Population, Properties of Normal Curve. Examples and exercises based on these concepts.

Unit-IV

χ^2- Distribution, Moment Generating Function of χ^2- Distribution, Mode and Skewness of χ^2- Distribution. Uniform Distribution, Its Mean, Mode, Variance and Moments about Mean, Properties of Uniform Distribution. Examples and exercises based on these concepts.

Text Books:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig,*Introduction to Mathematical Statistics*, Pearson Education, Asia, 2007.

Course Code : UMJMAT – 503
Course Title : Probability and Statistics

Reference Books:

1. Irwin Miller and Marylees Miller, John E. Freund, *Mathematical Statistics with Application,* 7th Ed., Pearson Education, Asia, 2006.

2. S. Lipschutz and J. Schiller, *Introduction to Probability and Statistics,* McGraw Hill Education, 2017.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER V
(Examination to be held in December 2024, 2025, 2026)
Minor Course

Course Code: UMIMAT-504
Course Title: Probability Theory
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This aim of this course is to provides the basics of probability theory and study some standard distributions such as binomial distribution, Poisson distribution, normal distribution etc.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Sample Space, Probability Axioms, Real Random Variable, Cumulative Distribution Function, Probability Mass/ Density Function, Mathematical Expectations, Moments About Origin and Moments about Mean, Moment Generating Function. Examples and exercises based on these concepts.

Unit-II

Bernoulli, Binomial and Poisson Distribution. Mean, Mode, Variance, Moments and Moment Generating Functions of these Distributions, Recurrence relations of Binomial and Poisson Distributions. Examples and exercises based on these concepts.

Unit-III

Normal Distribution, Mean, Mode, Variance, Median and Moments about Mean of Normal Distribution, 95% Confidence Interval for Mean of Population, Properties of Normal Curve. Examples and exercises based on these concepts.

Unit-IV

χ^2- Distribution, Moment Generating Function of χ^2- Distribution, Mode and Skewness of χ^2- Distribution. Uniform Distribution, Its Mean, Mode, Variance and Moments about Mean, Properties of Uniform Distribution. Examples and exercises based on these concepts.

Text Books:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig,*Introduction to Mathematical Statistics,* Pearson Education, Asia, 2007.

Course Code : UMIMAT – 504
Course Title : Probability Theory

Reference Books:

1. Irwin Miller and Marylees Miller, John E. Freund, *Mathematical Statistics with Application,* 7th Ed., Pearson Education, Asia, 2006.

2. S. Lipschutz and J. Schiller, *Introduction to Probability and Statistics,* McGraw Hill Education, 2017.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER V
(Examination to be held in December 2024, 2025, 2026)
Minor Course

Course Code: UMJMAT-505
Course Title: Set Theory
Credits: 02
Total Number of Lectures: Theory: 30
Maximum Marks: 50

Objectives: The aim of this course is to provide the fundamental concepts of sets and to study cardinal numbers, Cantor's Theorem etc.

Structure of the Course: This course is divided into three units of 10 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Sets, Subsets and operations on them, Indexed Families of Sets, Cartesian Product of Two Sets, Relations, Partitions and Equivalence Relations, Functions: Injective, Surjective and Bijective functions, Composition of Functions. Examples and exercises based on these concepts.

Unit-II

Finite and Infinite Sets, Equipotent Sets, Denumerable and Non-denumerable Sets and their properties. Examples and exercises based on these concepts.

Unit-III

The Concept of cardinal Numbers, Ordering of the Cardinal Numbers-The Schroder-Bernstein Theorem, Cardinal Number of Power Set- Cantor Theorem, Addition o Cardinal Numbers. Examples and exercises based on these concepts.

Text Books:

1. P. R. Halmos, *Naive Set Theory,* Springer, 2019.

Reference Books:

1. Lin, Shwu-Yeng T, *Set Theory with Applications,* Mancorp Publications, New Edition, 1985.

Course Code : UMJMAT – 505
Course Title : Set Theory

Scheme of Examination: (i) After covering half of the syllabus there shall be a Mid Term Assessment Test of 60 minutes duration carrying 10 marks. This test shall be conducted by the course coordinator.

Section A. Four(4) short answer questions atleast one question from each unit and each question shall carry two and half (2.5) marks. All questions shall be compulsory.

Section B. Six(6) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which three(3) questions are to be answered selecting at least one question from each unit. Each question shall carry 10 marks.

University of Jammu

Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER V

(Examination to be held in December 2024, 2025, 2026)

Minor Course

Course Code:USEMAT-506
Course Title: Summer Internship
Credits: 02
Maximum Marks: 50

Objectives: It shall be a short-term internship of 15 days duration in 5th semester for a job/professional training in a suitable organization or hands on training or activity-based course at college level in order to gain work experience.

All students will undergo internships / Apprenticeships in a firm, industry, or organization or Training in labs with faculty and researchers in their own or other HEIs / research institutions during the summer term. Students will be provided with opportunities for internships with local industry, business organizations, health and allied areas, local governments (such as panchayats, municipalities), Parliament or elected representatives, media organizations, artists, crafts persons, and a wide variety of organizations so that students may actively engage with the practical side of their learning and, as a by-product, further improve their employability.

Community engagement and service: The curricular component of "community engagement and service" seeks to expose students to the socio-economic issues in society so that the theoretical learning can be supplemented by actual life experiences to generate solutions to real-life problems. This can be part of summer term activity.

Field-based learning/minor project: The filed-based learning/minor project will attempt to provide opportunities for students to understand the different socio-economic contexts. It will aim at giving students exposure to development-related issues in rural and urban settings. It will provide opportunities for students to observe situations in rural and urban contexts, and to observe and study actual field situations regarding issues related to socioeconomic development. Students will be given opportunities to gain a first-hand understanding of the policies, regulations, organizational structures, processes, and programmes that guide the development process. They would have the opportunity to gain an understanding of the complex socio-economic problems in the community., and innovative practices required to generate solutions to the identified problems. This may be a summer term project.

SCHEME OF EXAMINATION

The internship shall be under a college teacher who will be designated as Internship Supervisor. After completion of summer internship students will have to produce a report related to the work carried out signed by internship supervisor and college principal. The internship will be evaluated internally by a Board of Examiners set up by the principal of the college.

Note: The minimum passing criteria for the summer internship is 40%.

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VI
(Examination to be held in May 2025, 2026, 2027)
Major Course

Course Code: UMJMAT-601
Course Title: Linear Algebra-II
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: To study linear transformation, dual spaces, linear transformations and matrix representation of linear transformation.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Linear Transformation (vector space homomorphism), isomorphism of two vector spaces, First fundamental theorem of isomorphism, kernel and image of a linear Transformation, $L(U, V)$ the set of all linear transformations from a vector space U to a vector space V is a vecor space, Examples and exercises based on these concepts.

Unit-II

$\dim L(U, V) = \dim(U)\dim(V)$, Dual space of a finite dimensional vector space, dual basis, $\dim(V^*) = \dim(V)$ for a finite dimensional vector space V, Double dual of a vector space, isomorphism between vector spaces and their double dual. Examples and exercises based on these concepts.

Unit-III

Algebra of linear transformations on a vector space, Rank-Nullity theorem, inverse of linear transformation on finite dimensional vector space, examples and exercises based on these concepts.

Unit-IV

Matrix representation of a linear transformation, one-one correspondence between linear transformations on finite dimensional vector spaces and matrices, Matrix representation of linear transformation with change of a basis, examples and exercises based on these concepts.

Text Books:

1. *University Algebra*, N. S. Gopalakrishnan, PHI.

Semester VI

Semester VI (MATHEMATICS)

4 Credits Courses

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
				4=3Th+1T	Theory		Tutorial		100
1.	Major	UMJMAT- 601	Linear Algebra-II	4	Mid Semester Examination: 15 Marks	End Semester Examination: 60 Marks	Continuous Assessment: 10 Marks	Final Exam: 15 Marks	
2.	Major	UMJMAT- 602	Numerical Methods	4					
3.	Major	UMJMAT- 603	Basic Complex Analysis	4					
4.	Major	UMJMAT- 604	Graph Theory	4					
5.	Major	UMJMAT 605	Abstract Algebra-III	4					
6.	Minor	UMIMAT- 606	Numerical Analysis	4					

- Students are required to opt any four major courses out of five given above.

Course Code : UMJMAT – 601
Course Title : Linear Algebra – II

Reference Books:

1. *Linear Algebra*, Kennneth Hoffman and Ray Kunz, PHI.
2. *Modern Algebra*, Surjeet Singh and Qazi Zameeruddin, Vikas Publishing House Pvt. Ltd.
3. *Algebra*, Michael Artin, PHI Pvt. Ltd.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VI
(Examination to be held in May 2025, 2026, 2027)
Major Course

Course Code: UMJMAT-602
Course Title: Numerical Methods
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course aims to study interpolation and inverse interpolation, numerical differentiation and numerical integration.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Finite differences, the operators Δ, ∇, E, D, and relations between them, separation of symbols. Interpolation: Linear and quadratic interpolation. Newton's forward and backward differences interpolation formula. Problems and Exercises based on these topics to be done as tutorials.

Unit-II

Central differences, Gauss's forward and backward interpolation formulas, Sterling's formula, Bessel's formula, Lagrange's interpolation formula (inverse interpolation). Problems and Exercises based on these topics to be done as tutorials.

Unit-III

Numerical Differentiation: Forward, backward and central difference formulas for numerical differentiation, maxima and minima of a tabulated function. Problems and Exercises based on these topics to be done as tutorials.

Unit-IV

Numerical Integration: Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rule, Boole's rule, Maclaurin's formula. Problems and Exercises based on these topics to be done as tutorials.

Text Books:

1. S. S. Sastry, *Introductory methods of Numerical Analysis, Prentice Hall of India,* Private Limited, 2005.

Course Code : UMJMAT – 602
Course Title : Numerical Methods

Reference Books:

1. B.S. Grewal, *Numerical Methods in Engineering and Science,* Khanna Publishers , 2010.

2. B. Braide,*A Friendly Introduction to Numerical Analysis,* Pearson Education, India, 2007.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.
(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VI
(Examination to be held in May 2025, 2026, 2027)
Major Course

Course Code: UMJMAT-603
Course Title: Basic Complex Analysis
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course aims to study the functions of complex variable along with their limit, continuity, differentiablity and analyticity. The student will also study the necessary and sufficient condition for a complex valued function of complex variable to be analytic

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

De-Moivre's Theorem, Applications of De-Moivre's Theorem in finding the roots of complex numbers, solutions of polynomial equations, expressing sines and cosines in terms of sines and cosines of multiples of angle and vice-versa. Problems and Exercises based on these topics to be done as tutorials.

Unit-II

Function of complex variable: Exponential Functions, Logarithmic Functions, Circular and Hyperbolic Functions, Inverse Circular Functions, relation between them and their properties. Problems and Exercises based on these topics to be done as tutorials.

Unit-III

Limits, Continuity, regions in the complex planes, mapping and differentiability, Cauchy-Riemann equations, Sufficient condition for differentiability. Problems and Exercises based on these topics to be done as tutorials.

Unit-IV

Analytic Functions, examples of analytic functions, Cauchy-Riemann equations and its polar form, Necessary and sufficient condition for analyticity, harmonic function, construction of analytic function. Problems and Exercises based on these topics to be done as tutorials.

Course Code : UMJMAT – 603
Course Title : Basic Complex Analysis

Text Books:

1. T. Gamelin, *Complex Analysis,* Springer.

Reference Books:

1. J. W. Brown and R. V. *Churchill, Complex variables and applications,* McGraw-Hill Higher Education.
2. L. Ahlfors, *Complex Analysis,* McGraw-Hill Book Company.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VI
(Examination to be held in May 2025, 2026, 2027)
Major Course

Course Code: UMJMAT-604
Course Title: Graph Theory
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course will provide the fundamental concepts of graph theory such as graphs, trees, cut sets etc.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Graphs, Applications of graphs, finite and infinite graphs, Incidence and degree, Isomorphism, Subgraphs, Walks, paths and circuits, connected graphs, disconnected graphs and components.Exercises and examples based on these topics.

Unit-II

Bipartite graph, Degree-sum formula, Graphic Sequences,Euler Graphs, Operations on graphs, More on Euler graphs, Hamiltonian paths and circuits. Exercises and examples based on these topics.

Unit-III

Trees, some properties of trees, Pendant vertices in a tree, Distance and centers in a tree, Enumeration of Trees, Spanning trees, Weighted graphs, Spanning trees in a weighted graph.Exercises and examples based on these topics.

Unit-IV

Cut-sets,some properties of cut-sets, All cut-sets in a graph, Fundamental circuits and cut-sets, Connectivity and separability, Homeomorphism of graphs, Planar graphs, Kuratowski's two graphs, Different representations of a planar graph. Exercises and examples based on these topics.

Text Books:

1. Narsingh Deo, *Graph Theory with Applications to Engineering and Computer Science,* PHI Learning Pvt. Ltd, Delhi, 2019.

Course Code : UMJMAT – 604
Course Title : Graph Theory

Reference Books:

1. D.B. West, *Introduction to Graph Theory,* Prentice Hall, 2001
2. R. Balakrishnan and K. Ranganathan, A Textbook of Graph Theory, Springer-Verlag New York, 2012.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VI
(Examination to be held in May 2025, 2026, 2027)
Major Course

Course Code: UMJMAT-605
Course Title: Abstract Algebra-III
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course develops the well scientific knowledge of ring theory which is an important algebraic structure in Mathematics (especially in Algebra). It provides deep study of some interesting rings such as Euclidean Rings (Domain), Principal Ideal Domain, Unique Factorisation Domain and ring of polynomials over a field which is very useful in the study of Galois Theory.
Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Conjugacy classes, class equation, centre of a group, Cauchy's theorem, p-groups, Sylow's Theorem I, II and III, Internal direct sums and direct products of finite groups. Finite Abelian groups as direct sums of Sylow subgroups.

Unit-II

Normal and subnormal series, Solvable groups, Solvability of subgroups, factor groups and of finite p-groups, Commutator subgroups and solvability. Simple groups. Composition series. Jordan-Holders theorem for finite groups. Simplicity and non-solvability of A_n, $n \geq 5$.

Unit-III

Modules, submodules, sum of submodules, finitely generated modules, cyclic modules, finite direct sum and direct product. Quotient Modules, homomorphisms, Isomorphism theorems, Submodules of Quotient Modules, Ring as a modules over itself and its submodules, Algebra of ideals of a ring, maximal and prime ideals, ideals of quotient Ring.

Unit-IV

Unit, prime and irreducible elements of a ring. Factorization domain and the ascending chain condition on principal ideals. R[x] the polynomial rings as a factorization domain when R is a factorization domain. The ring Z[x] as a factorization domain. Euclidean domain and principal ideal domain as factorization domains. Unique factorization domain and the irreducible and prime

elements of U.F.D., Polynomial rings over a U.F.D. Eisenstein's irreducibility criterion and Gauss theorem.

Text Books:

1. L. N. Herstein, Topics in Algebra, Wiley, 2nd edition, 1975. (Unit-I and II)
2. D. S. Dummit and R. M. Egote, Abstract Algebra, Wiley, 3rd edition, 2011.

Reference Books:

1. J. A. Gallian, Contemporary Abstract Algebra, 9th Edition, Brooks/Cole Cengage Learning, 2017.
2. N. Jacobson, Basic Algebra I, Dover Publications Inc, 2nd edition, 2009.
3. T. A. Hungerford, Algebra, Graduate Texts in Mathematics, Springer-Verlag, 1980.
4. C. Musili, Introduction to Rings and Modules, Narosa Publishing House, 1984.
5. N.S.Gopalakrishnan, University Algebra, second Edition, Wiley Eastern Ltd., New Delhi 1994.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VI
(Examination to be held in May 2025, 2026, 2027)
Minor Course

Course Code: UMIMAT-606
Course Title: Numerical Analysis
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course aims to study interpolation and inverse interpolation, numerical differentiation and numerical integration.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Finite differences, the operators Δ, ∇, E, D, and relations between them, separation of symbols. Interpolation: Linear and quadratic interpolation. Newton's forward and backward differences interpolation formula. Problems and Exercises based on these topics to be done as tutorials.

Unit-II

Central differences, Gauss's forward and backward interpolation formulas, Sterling's formula, Bessel's formula, Lagrange's interpolation formula (inverse interpolation). Problems and Exercises based on these topics to be done as tutorials.

Unit-III

Numerical Differentiation: Forward, backward and central difference formulas for numerical differentiation, maxima and minima of a tabulated function. Problems and Exercises based on these topics to be done as tutorials.

Unit-IV

Numerical Integration: Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rule, Boole's rule, Maclaurin's formula. Problems and Exercises based on these topics to be done as tutorials.

Text Books:

1. S. S. Sastry, *Introductory methods of Numerical Analysis, Prentice Hall of India,* Private Limited, 2005.

Course Code : UMIMAT – 606
Course Title : Numerical Analysis

Reference Books:

1. B.S. Grewal, *Numerical Methods in Engineering and Science,* Khanna Publishers , 2010.

2. B. Braide,*A Friendly Introduction to Numerical Analysis,* Pearson Education, India, 2007.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

Semester VII

Semester VII (MATHEMATICS)

4 Credits Courses

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
				4=3Th+1T	Theory		Tutorial		100
1.	Major	UMJMAT- 701	Topology-I	4	Mid Semester Examination: 15 Marks	End Semester Examination: 60 Marks	Continuous Assessment: 10 Marks	Final Exam: 15 Marks	
2.	Major	UMJMAT- 702	Measure Theory	4					
3.	Major	UMJMAT- 703	Differential Geometry	4					
4.	Major	UMJMAT- 704	Complex Analysis	4					
5.	Major*	UMJMAT-705	Research Methodology	4					
6.	Major	UMJMAT-706	Theory of Optimization	4					
7.	Minor	UMIMAT- 707	Optimization Theory	4					

- Honor\Research Students are required to choose four major courses out of six given above however UMJMAT-705 is compulsory for students opting for Research.

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VII
(Examination to be held in December 2025, 2026, 2027)
Major Course

Course Code: UMJMAT-701
Course Title: Topology-I
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This aim of this course is to study the fundamental concepts of topological spaces, continuous functions between topological spaces, homeomorphism between topological spaces, metrizable topology and compact topological spaces.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Topological spaces, basis and subbasis for a topology, order topology, product topology of $X \times Y$, Subspace topology, closed sets and limit points, closure and interior sets, Hausdorff space. Problems and exercises based on these concepts.

Unit-II

Continuous functions, homeomorphisms, the pasting lemma, product topology, box topology, uniform topology and their relationships, Quotient topology, Quotient spaces. Problems and exercises based on these concepts.

Unit-III

Metric topology, metrizable spaces, the sequence lemma, Uniform limit theorem, connectedness, path connectedness, components and local connectedness. Problems and exercises based on these concepts.

Unit-IV

Compact spaces, compact subspaces of a real line, uniform continuity theorem, finite intersection property, limit point compactness, sequential compactness, nets and filters, their convergence, subnets and cluster points. Problems and exercises based on these concepts.

Text Books:

1. J. R. Munkres, *Topology*, Pearson Education India, 2013.

Course Code : UMJMAT – 701
Course Title : Topology – I

Reference Books:

1. M. H. A. Newman,*Elements of the Topology of Plane Sets of Points,* 2nd edition, Cambridge University Press, 1951.
2. S. Willard, *General Topology*, Addison Wesley, 1970.
3. G. F. Simmons, *Introduction to Topology and Modern Analysis*, McGraw-Hill Education, 1963.
4. J. Dugundji, *Topology,* Allyn and Bacon, 1966.
5. J. L. Kelly, *General Topology,* Springer Science and Business Media, 1975.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VII
(Examination to be held in December 2025, 2026, 2027)
Major Course

Course Code: UMJMAT-702
Course Title: Measure Theory
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: The main purpose of this course is to study general theory of measure integration. The theory of measures has its origin in the idea of length, area, and volume in Euclidean spaces. It has a lot of application in functional theory and several branches of Physics.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

σ-algebra of sets, limit of sequences of sets, Generation of algebras, Borel σ-algebra, G_δ and F_δ sets, Measure on σ-algebra, Measurable spaces and measure space. Outer measures, regular outer measure, metric outer measure, construction of outer measure. Examples and exercises on these topics.

Unit-II

Lebesgue outer measure on $\mathbb{R}$, properties of Lebesgue measure spaces, translation invariance of Lebesgue measure, Existence of non-Lebesgue measurable sets. Regularity of Lebesgue outer measure, Cantor ternary set and cantor function, Relation between Lebesgue and Borel measurability, completion of measure space, Completion of Borel measure space to the Lebesgue measure space. Examples and exercise on these topics.

Unit-III

Measurable functions, Operation with measurable function, equality a.e., sequence of measurable functions, continuity and Borel Lebesgue measurability of function on $\mathbb{R}$, integration of simple functions, Lebesgue integral of non-negative and measurable functions, properties of Lebesgue integrals. Examples and exercises on these topics.

Course Code : UMJMAT – 702
Course Title : Measure Theory

Unit-IV

Convergence a.e., Almost uniform convergence, Ergroff's theorem, convergence in measure, convergence in mean, Cauchy sequence in measure, relation among various convergence types, Fatou's lemma, Lebesgue monotone convergence theorem, Lebesgue dominated theorem. Examples and exercises based on these concepts.

Text Books:

1. J. Yeh, *Lectures on real Analysis*, World Scientific, 2000.

Reference Books:

1. M. E. Munore, *An Integration*, Addison Wesley, 1971.
2. G. D. Barra, *Measure Theory and Integration*, Willey Eastern 1987.
3. H. L. Royden, *Real Analysis*, 3rd edition, Macmilon, New York, 1988.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VII
(Examination to be held in December 2025, 2026, 2027)
Major Course

Course Code: UMJMAT-703
Course Title: Differential Geometry
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: Being a fundamental course, this course aims at preparing students to realise and do mathematics geometrically by understanding curves, surfaces and geodesics.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Curves: Differentiable curves, arc length, parametrization by arc length, plane curves, plane curvature, Directed curvature, Fundamental Theorems for plane curves. Curves in space: Tangent, normal and binormal unit vectors, curvature and torsion, Oriented Serret frame, Fernet-Serret theorem. Fundamental Theorem for curves in $\mathbb{R}^3$. Properties of curves such as Helix, Bertrand involute curves on sphere.

Unit-II

Surfaces: A regular surface, examples, coordinate charts, change of coordinate, differentiable functions, diffeomorphism, tangent plane, unit normal vector, oriented surfaces, first fundamental form, element of arc length, invariance of line element under coordinate change, angle between two curves, orthogonal parametrization, Area, curvature for surfaces, Euler's work on surfaces, Principle curvatures, line of curvature. Rodrigue's formula, Gauss map, second fundamental form. Meusiner's theorem, Gaussian curvature, Dupin indicatrix.

Unit-III

Metric Equivalence of Surface: Isometry, local isometry, Christoffel symbols, Theorema Egreguem, Gauss equations, Mainardi-Codazzi equations, Statement of Fundamental theorem for regular surfaces, Line of curvature, asymptotic line, special, Geodesic curvature.

Course Code : UMJMAT – 703
Course Title : Differential Geometry

Unit-IV

Geodesics: Local distance, minimizing properties of geodesics, exponential map, Hopf-Rinow Theorem, Statement of Hopf's Umlaufsatz, Gauss-Bonnet Theorem, Some applications of Gauss-Bonnet Theorem.

Text Books:

1. John McCleary, *Geometry From a Differentiable Point of View,* Cambridge University Press, 1994.

Reference Books:

1. D. T. Struik, *Differential Geometry,* Addison Wesley, 1961.
2. N. Parkash, *Differential geometry,* Tata MacGraw Hill, Publication Company, New Delhi.
3. W. Klingenberg, *A course in Differential Geometry,* Springer-Verlag, New York, 1976.
4. M. Do Carmo, *Differential Geometry of Curves and surfaces,* Prentince Hall Englewood Cliff's, N. J. 1976.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VII
(Examination to be held in December 2025, 2026, 2027)
Major Course

Course Code: UMJMAT-704
Course Title: Complex Analysis
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course is a continuation of UMJMAT-603 and its main objectives are to study Cauchy integral theorem and its consequences, sequences and series of analytic functions, residue calculus and conformal mappings.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Spherical representation of complex numbers and the extended complex plane, real differentiability, the functions f_z and $f_{\bar{z}}$.
Complex Integration: Paths in the Complex Plane, Smooth and Piecewise Smooth Paths, Parametrizing of Paths, Change of parameter, Integral Along Paths, Complex Line Integrals, Properties of Contour Integrals and Primitives, Rectifiable Paths, Integral Along Rectifiable Paths. Examples and Exercises based on these topics.

Unit-II

Cauchy Theorem for a rectangle, Integral and Primitives, Cauchy Theorem for a disk. Winding numbers, Oriented Paths, Jordon Contours, the Cauchy Integral formula, the Cauchy Integral Formula for higher deerivatives-analyticity of derivatives. Derivatives Estimates. Maximum Principle, Schwarz Lemma and Hadamard Three Circle theorem. Simply Connected Domains, Simple Connectivity, Primitives and Logarithms.

Unit-III

Sequences and Series of Analytic Functions: Uniform convergence and normal convergence, general results, Taylor's series, Laurent's series and Laurent's Theorem. Zeros of analytic functions, classification of isolated singularities of analytic functions-removable singularity, pole and essential singularity and singularity at infinity. Cauchy Residue Theorem and evaluating integrals with Cauchy Residue theorem, Consequences of Cauchy Residue Theorem.

Course Code : UMJMAT – 704
Course Title : Complex Analysis

Unit-IV

Conformal Mappings: Curvilinear angles, Diffeomorphisms, Conformal Mapping, Some standard Conformal Mappings, Self-mappings of the Plane and the Unit disk, Conformal Mappings in the Extended Plane. Mobius Transformations: Elementary Mobius Transformations, Mobius Transformation and mtarices, Fixed points, Cross-Ratios, Circle in the Extended Plane. reflection and symmetry, classification of Mobius transformations and Invariant Circles.

Text Books:

1. Bruce P. Palka, *An introduction to Complex Function Theory*, Springer Science -Business Media, New York, 1991.

Reference Books:

1. Lars V. Ahlfors, *Complex Analysis,* McGraw-Hill International Editions, 1979.
2. John B. Conway, *Functions of One Complex Variable,* Narosa Publishing House, 1990.
3. T. W. Gamelin, *Complex Analysis*, Springer, 2001.
4. S. Ponnusamy and Herb Silverman, *Complex Variables with Applications,* Birkhauser, 2006.
5. Serge Lvovski, *Principles of Complex Analysis,* Springer, 2020.
6. Reinhold Remmert, *Theory of Complex Functions,* Springer, 1991.
7. Steven G. Krantz, *Complex Variables,* Chapman and Hall-CRC, 2008.
8. Joseph L. Taylor, *Complex Variables,* American Math. Soc., 2011.
9. Elias M. Stein and Rami Shakarchi, *Complex Analysis,* Princeton University Press, 2003.
10. Zeev Nihari, *Conformal Mappings,* Dover Publications Inc. New York, 1975.
11. Robert B. Ash and W. P. Woringer, *Complex Analysis,* Dover Publications, 2007.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Course Code : UMJMAT – 704
Course Title : Complex Analysis

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VII
(Examination to be held in May 2025, 2026, 2027)
Major Course

Course Code: UMJMAT-705
Course Title: Research Methodology
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course includes the preliminary study of research. **Structure of the Course:** This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Overview of research process: Meaning of research, various approaches of research, significance of research, parameter of good research, developing the objectives, preparing the Research Design.

Unit-II

Literature survey, What is literature survey? Functions of literature survey Searching for Publications, Publication databases, search engines and Online tools-Open sources, open access Journals, (other important websites, groups and societies). Subscribed sources, IEEE Springer link, Sci av direct, AMS. LMS, JSTOR INFLIB NET) Survey papers. Math Sci Net, use of scientific workplace, MATLAB/MATHEMATICA for scientific calculations and visualization of data.

Unit-III

LaTeX for typesetting-How to write a mathematics document in LaTeX. Understanding the key research area of interest. Conditions and Steps in selecting a research problem, Sources of research problem: Creative thinking techniques, Study of research gaps, Critical reading of research papers formulating the research problem and writing the synopsis, Method of writing a good research paper, publishing a research paper.

Unit-IV

Commercialization, Copy Right, Reproduction of published material, Plagiarism, Citation and acknowledgment, Reproducibility and account ability standards of quality (Refereed, indexed, impact factor paper citation Index etc.) Indexing databases (Math sci net, ZB Math, AMS Mathematical Reviews, Scopus

etc.), Critical evaluation of standards of quality. Preparing seminar presentation, Preparing research report, Preparing bibliography (various styles).

Text Books:

1. A. Gilat, *MATLAB, An Introduction With Applications,* Wiley India Edition.

Reference Books:

1. C. Hastings, K. Mischo, M. Morrison,*Hands-On Start to Wolfram Mathematica*, Wolfram Media Inc. 2015.
2. G. Gratzer, *More Math into LaTeX*(4th Edition), Springer 2007.
3. C. R. Kothari, G. Garg, *Research Methodology, Methods and Techiniques*, (Third Edition) New Age International Publishers.
4. Dr. Pramod Kumar Naik, Dr. Pushkar Dubey,*Research Methodology*, APH Publishing Corporation.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VII
(Examination to be held in December 2025, 2026, 2027)
Major Course

Course Code: UMJMAT-706
Course Title: Theory of Optimization
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: The main objective of the course is to formulate mathematical models and to understand solution methods for real life optimal decision problems. The emphasis will be on basic study of linear programming problem, Integer programming problem, Transportation problem, Two person zero sumgames with economic applications.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Sequences and Subsequences, Mapping and functions, Continuous functions, Infimum and Supremum of functions, Minima and maxima of functions, Differentiable functions. Vectors and vector spaces, Matrices, Linear transformation, Quadratic forms, Definite quadratic forms, Linear equations, Solution of a set of linear equations, Basic solution and degeneracy.

Unit-II

Convex sets and Convex cones, Introduction and preliminary definition, Convex sets and properties, Convex Hulls, Extreme point, Separation and support of convex sets, Convex Polytopes and Polyhedra Convex cones, Convex and concave functions, Basic properties, Differentiable convex functions, Generalization of convex functions.

Unit-III

Linear Programming: Geometry of linear programming, Graphical method, Linear programming (LP) in standard form, Solution of LP by simplex method, Two phase method, Big M method, Exceptional cases in LP, Duality theory, Dual simplex method. Integer Programming: Branch and bound technique.

Course Code : UMJMAT – 706
Course Title : Theory of Optimization

Unit-IV

Transportation and Assignment Problem: Initial basic feasible solutions of balanced and unbalanced transportation/assignment problems, Optimal solutions, Travelling salesman problem. Game Theory: Two person zero-sum game, Game with mixed strategies, Graphical method and solutionby linear programming.

Text Books:

1. Swarup, K., Gupta, P. K., Manmohan, *Operations Research,* Sultan Chand and Sons, (2010).
2. Taha H. A., *Operations Research An Introduction,* PHI (2007).

Reference Books:

1. S. S. Rao, *Engineering Optimization. Theory and Practice;* Revised 3rd Edition, New Age International Publishers, New Delhi.
2. G. Hadley, *Linear Programming,* Addison Wesley.
3. N. S. Kambo, *Mathematical Programming Techniques,* East West Press, 1991.
4. S. Chandra Jayadeva, A. Mehra, *Numerical Optimization and Applications,* Narosa Publishing House, (2013).

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VII
(Examination to be held in December 2025, 2026, 2027)
Minor Course

Course Code: UMIMAT-707
Course Title: Optimization Theory
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: The main objective of the course is to formulate mathematical models and to understand solution methods for real life optimal decision problems. The emphasis will be on basic study of linear programming problem, Integer programming problem, Transportation problem, Two person zero sumgames with economic applications.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Sequences and Subsequences, Mapping and functions, Continuous functions, Infimum and Supremum of functions, Minima and maxima of functions, Differentiable functions. Vectors and vector spaces, Matrices, Linear transformation, Quadratic forms, Definite quadratic forms, Linear equations, Solution of a set of linear equations, Basic solution and degeneracy.

Unit-II

Convex sets and Convex cones, Introduction and preliminary definition, Convex sets and properties, Convex Hulls, Extreme point, Separation and support of convex sets, Convex Polytopes and Polyhedra Convex cones, Convex and concave functions, Basic properties, Differentiable convex functions, Generalization of convex functions.

Unit-III

Linear Programming: Geometry of linear programming, Graphical method, Linear programming (LP) in standard form, Solution of LP by simplex method, Two phase method, Big M method, Exceptional cases in LP, Duality theory, Dual simplex method. Integer Programming: Branch and bound technique.

Course Code : UMIMAT – 707
Course Title : Optimization Theory

Unit-IV

Transportation and Assignment Problem: Initial basic feasible solutions of balanced and unbalanced transportation/assignment problems, Optimal solutions, Travelling salesman problem. Game Theory: Two person zero-sum game, Game with mixed strategies, Graphical method and solution by linear programming.

Text Books:

1. Swarup, K., Gupta, P. K., Manmohan, *Operations Research,* Sultan Chand and Sons, (2010).
2. Taha H. A., *Operations Research An Introduction,* PHI (2007).

Reference Books:

1. S. S. Rao, *Engineering Optimization. Theory and Practice;* Revised 3rd Edition, New Age International Publishers, New Delhi.
2. G. Hadley, *Linear Programming,* Addison Wesley.
3. N. S. Kambo, *Mathematical Programming Techniques,* East West Press, 1991.
4. S. Chandra Jayadeva, A. Mehra, *Numerical Optimization and Applications,* Narosa Publishing House, (2013).

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

Semester VIII

Semester VIII (MATHEMATICS)

(Honors)

4 Credits Courses

S. No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
				4=3Th+1T	Theory		Tutorial		100
1.	Major	UMJMAT- 801	Commutative Algebra	4	Mid Semester Examination: 15 Marks	End Semester Examination: 60 Marks	Continuous Assessment: 10 Marks	Final Exam: 15 Marks	
2.	Major	UMJMAT- 802	Advance Complex Analysis	4					
3.	Major	UMJMAT-803	Functional Analysis	4					
4.	Major	UMJMAT-804	Cryptography	4					
5.	Major	UMJMAT- 805	Fluid Dynamics	4					
6.	Major	UMJMAT- 806	Topology-II	4					
7.	Minor	UMIMAT- 807	Partial Differential equation	4					

- The candidate has to opt any four major courses of credits 4 out of the six given above.

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VIII
(Examination to be held in May 2026, 2027, 2028)
Major Course

Course Code: UMJMAT-801
Course Title: Commutative Algebra
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course provides the preliminary study of another algebraic structure- Modules and some of its types such as free modules, flat modules and faithful modules.

Prerequisite of this course: The knowledge of Algebra-I (UMJMAT402), Algebra-II (UMJMAT501) and Algebra-III(UMJMAT605) studied in Semester-IV, V & VI respectively.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Review of Rings and Ideals. R-modules, submodules, R-module homomorphism and isomorphism, Quotient module, Kernel of R-module homomorphism, Submodule generated by N and K, where N is a submodule of M and K is a submodule of N, Cyclic R-module, Annihilator of an R-module, Faithful R-module, Finitely Generated R-module, Direct Sum of R-modules, Free Modules. Examples and exercises based on these concepts.

Unit-II

Review of PID, Exact Sequence, Split exact sequence and related results; Projective R-modules and their properties; Finitely generated and Finitely presented R-module, Shaneul's Lemma. Examples and exercises based on these concepts.

Unit-III

R-bilinear map, Tensor Product of two R-modules and their properties, Existence and Uniqueness of Tensor product of two R-modules, Behaviour of Tensor product with respect to exact sequences; Flat R- modules, Faithfully Flat R-modules and related results. Examples and exercises based on these concepts.

Course Code : UMJMAT – 801
Course Title : Commutative Algebra

Unit-IV

Review of Prime and Maximal Ideals, Prime Avoidance Theorem; Nilpotent elements, Nil radical of R, Nil radical of R as the intersection of all prime ideals of R; Jacobson radical of R, characterization of an element of Jacobson radical of R; Comaximal Ideals, Chinese Remainder Theorem and related results; Radical of an ideal I of R ($\sqrt{I}$), $\sqrt{I}$ as the intersection of all prime ideals containing I. Examples and exercises based on these concepts.

Text Books:

1. NS Gopala Krishnan, *Commutative Algebra* (Second Edition) University Press (India) Private Limited.

Reference Books:

1. Andrea Ferreti, *Commutative Algebra,* Graduate studies in Mathematics, AMS.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VIII
(Examination to be held in May 2026, 2027, 2028)
Major Course

Course Code: UMJMAT-802
Course Title: Advance Complex Analysis
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: The main objective of this course is to study some advance topics in Complex Analysis.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Harmonic Functions: Harmonic Conjugates, necessary and sufficient condition for the existence of harmonic conjugates, mean value property, Gauss Mean Value Theorem, Poisson Integral Formula, Dirichlet Problem on the open disk, characterization of harmonic functions, Schwarz Reflection Principle, analytic continuation, Monodromy Theorem.

Unit-II

Equicontinuous families of continuous functions, Arzela-Ascoli Theorem, normal subfamilies of continuous functions, Montel's Theorem, Riemann Mapping Theorem, The Schwarz-Christoffel Formula.

Unit-III

Normal families of meromorphic functions: Spherical derivative, Marty's Theorem, Zalcman's Lemma, Montel's Three value Theorem, Picard's Theorem. Applications of normality: Fatou and Julia sets of meromorphic functions and their basic properties.

Unit-IV

Runge's Theorem, the series of meromorphic functions, constructing meromorphic function: the Mittag-Leffer Theorem, the Weierstrass $\mathcal{P}$-function, infinite products, infinite products of functions, infinite products and analytic functions, the Weierstrass Factorization Theorem and its consequences.The Gamma function, the Riemann ζ- function and their properties, the Prime Number Theorem.

Course Code : UMJMAT – 802
Course Title : Advance Complex Analysis

Text Books:

1. T. W. Gamelin, *Complex Analysis*, Springer, 2001.

Reference Books:

1. Lars V. Ahlfors, *Complex Analysis,* McGraw-Hill International Editions, 1979.
2. John B. Conway, *Functions of One Complex Variable,* Narosa Publishing House, 1990.
3. Bruce P. Palka, *An introduction to Complex Function Theory*, Springer Science -Business Media, New York, 1991.
4. S. Ponnusamy and Herb Silverman, *Complex Variables with Applications,* Birkhauser, 2006.
5. Serge Lvovski, *Principles of Complex Analysis,* Springer, 2020.
6. Reinhold Remmert, *Theory of Complex Functions,* Springer, 1991.
7. Steven G. Krantz, *Complex Variables,* Chapman and Hall-CRC, 2008.
8. Joseph L. Taylor, *Complex Variables,* American Math. Soc., 2011.
9. Elias M. Stein and Rami Shakarchi, *Complex Analysis,* Princeton University Press, 2003.
10. Zeev Nihari, *Conformal Mappings,* Dover Publications Inc. New York, 1975.
11. Robert B. Ash and W. P. Woringer, *Complex Analysis,* Dover Publications, 2007.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Course Code : UMJMAT – 802
Course Title : Advance Complex Analysis

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VIII
(Examination to be held in May 2026, 2027, 2028)
Major Course

Course Code: UMJMAT-803
Course Title: Functional Analysis
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course aims at familiarizing the students with the geometry of metric spaces, Banach Spaces and Hilbert spaces. Some fundamental theorems in functional analysis like Banach contraction Principle, Hahn-Banach Theorem, uniform boundedness principle are included in the syllabus. These theorems have immense applications in several branches of Mathematics and Mathematical physics. A preliminary knowledge of modern algebra, Real and Complex analysis, General topology and measure theory is essential for smooth sailing in this course.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Definition of metric spaces, convergence complete metric spaces, Banach contraction Principle and its applications to differential and integral equations, completion theorem, category theorem and its applications, compactness , Arzela-Ascoli's Theorem, Problems and examples based on these concepts.

Unit-II

Normed linear spaces and Banach spaces, examples, finite dimensional normed linear spaces, equivalent norms quotient spaces, F. Riesz's lemma , Bounded linear operators, examples, dual spaces, computation of duals of IR, $l_p, 1 \leq p < \infty$ and Co.

Unit-III

Hahn-Banach Theorem in real, Complex and linear spaces and applications, reflexive spaces, uniform boundedness principle, open mapping theorem, Bounded inverse-theorem, closed graph theorem.

Course Code : UMJMAT – 803
Course Title : Functional Analysis

Unit-IV

Inner product spaces, the Cauchy-Schwartz inequality, the Phythagorean Theorem, Hilbert spaces, examples of Hilbert spaces. Orthogonal complement and direct sum, minimizing vector theorem, projection theorem, orthonormal sets, Bessel's inequality orthonormal basis, the existence of orthonormal basis Riesz representation theorem, the dimension of Hilbert spaces. Adjoint of a linear operator, self adjoint, normal and unitary operators.

Text Books:

1. C. Goffman and G. Padrick, *First course in Functional Hall Analysis,* Prentice 1955.(for unit -1).
2. E. Kreyszig, *Introductory Functional Analysis with Applications*, John Wiley and Sons 1978. (For unit- II, III and IV)

Reference Books:

1. R. G. Douglas, *Banach Algebra Techniques in operator Theory,* Springer-Verlag, New York 1998.
2. J. B. Conway, *A course in Functional Analysis,* Springer Verlag, 1973.
3. B. V. Limaye, *Functional Analysis,* Wiley Eastern Ltd. 1981.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VIII
(Examination to be held in May 2026, 2027, 2028)
Major Course

Course Code: UMJMAT-804
Course Title: Cryptography
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: Discuss about various encryption techniques. Understand the concept of public key Cryptography. Introduce message authentication and hash function. Provide Lab sessions for each unit to help gain deeper insight into Cryptography.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Introduction to cryptography, cryptanalysis, and cryptology, Overview of cryptography, Basic Cryptographic primitives, Classical ciphers: substitution cipher-Caesar, Playfair and Hill cipher, Transposition cipher - Rail fence, Columnar and Double columnar, Cryptanalysis of classical ciphers, Introduction to probability, Conditional probability, Law of Total probability, Shannon's theorem, One-time-pad encryption, Limitations of One-Time-Pad. Algebraic structures - Rings, Fields and groups.

Unit-II

Introduction to symmetric key cryptography, Pseudo Random Numbers, Feistel Cipher, S-box and E-box, Initial and Final permutations, Data Encryption Standard (DES), Cryptanalysis and avalanche effect, AES (Advanced Encryption Standard), Key Scheduling, Side channel attacks, Block and Stream ciphers.

Unit-III

Introduction to Public key cryptography, Modes of operation, Prime number, Primitive root, Modular arithmetic, Polynomials, Diffie Hellman Protocol(DH Protocol), Elgamal crypto systems, Prime Factorization, Rivest-Shamir-Adleman cryptosystem (RSA).

Course Code : UMJMAT – 804
Course Title : Cryptography

Unit-IV

Key management and distribution (KDC), Birthday attack, Entity authentication methods, password, challenge response, Zero knowledge protocols, message digest algorithm (MD5), One-way function, Collision resistant hash function (CRHF), Secure Hash Algorithm (SHA), Applications.

Text Books:

1. J. Katz and Y. Lindell,*Introduction to Modern Cryptography*, 2nd Edition, CRC Press, 2015.

Reference Books:

1. B. A. Foruzan, *Cryptography and Network Security*, 3rd Edition, Tata McGraw Hill, 2017.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VIII
(Examination to be held in May 2026, 2027, 2028)
Major Course

Course Code: UMJMAT-805
Course Title: Fluid Dynamics
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: The aim of this course is to understand the various properties of fluids and their influence on fluid motion and analyse a variety of problems in fluid statics and dynamics and to give the student practice in the analytical formulation of fluid mechanics problems using Newton's Laws of motion and thermodynamics; an introduction to experimental methods;

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Types of fluids, Lagrangian and Eulerian method of describing fluid motion, most general motion of the fluid element: translation, rotation and deformation. Stream lines, path lines and streak lines, material derivative, acceleration components of fluid particle in cartesian, cylindrical and spherical polar coordinates (without proof), vorticity vector, vortex lines, rotational and irrotational motion.

Unit-II

Velocity, potential boundary surface, boundary condition. Irrotational motion in two-dimensional, stream functions, complex velocity potential, sources, sinks, doublets and their images in two dimensional. Continuum hypothesis, Newton's law of viscosity, some cartesian tensor notations.

Unit-III

Stress Analysis: Stress at a point, Stress in a fluid at rest, Stress in a fluid in motion, Relation between stress and rate of strain components (Stokes' Law of Friction), Thermal conductivity, Generalized law of heat conduction. Fundamental Equations of the flow of viscous fluids: Introduction, Equation of State, Equation of continuity, Equations of motion (Navier-Stokes Equations), Equation of energy, Vorticity and Circulation (Kelvin's Circulation Theorem).

Course Code : UMJMAT – 805
Course Title : Fluid Dynamics

Unit-IV

Dynamical similarity (Reynolds law), Inspection analysis, Dimensional analysis, Buckingham π theorem and its application, π product and coefficients, Non-dimensional parameter and their physical importance. Exact solution of the $N - S$ Equations, Steady motion between the parallel plates (a) velocity distribution, (b) Temperature distribution, Plane couette flow, Plane Poiseuille flow, Generalized plane Couette flow. Flow in a circular pipe (Hagen-Poiseuille flow) (a) Velocity distribution, (b) temperature distribution. Theory of very slow motion: Flow past a sphere (Stokes and Oseen flow).

Text Books:

1. J. L. Bansal, *Viscous fluid dynamics,* Oxford and IBH Publishing Company Pvt. Ltd., (1977).
2. F. Chorlton, *Text book of fluid dynamics,* CBS Publishers and distribution (2000).

Reference Books:

1. G. K. Batchelor, *An introduction to fluid dynamics,* Cambridge University press, (1970).
2. C. S. Yih, *Fluid Mechanics,* McGraw-Hill Book Company.
3. S. W. Yuan, *Foundation of Fluid Mechanics,* PHI Pvt Ltd. New Delhi (1969).

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Course Code : UMJMAT – 805
Course Title : Fluid Dynamics

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.
(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VIII
(Examination to be held in May 2026, 2027, 2028)
Major Course

Course Code: UMJMAT-806
Course Title: Topology-II
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: The objective of this course is to introduce and explore advanced topology such as countability axioms,separation axioms, Urysohn lemma, the Urysohn Metrization Theorem, the Tietze extension theorem, local compactness, one-point compacification, Ascoli's theorem and Baire spaces.

Prerequisite of this course: The knowledge of Topology-I(UMJMAT-701) studied in seventh semester.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

The countability axioms, the separation axioms, Normal spaces, the Urysohn Lemma, the Urysohn Metrization Theorem, the Tietze extension Theorem, m-manifolds, Embedding of Manifolds, Theorem on existence of finite partitions of Unity. Problems and exercise based on these concepts.

Unit-II

Local compactness, one-point compacification, the Tychnoff theorem for finite products, Tychnoff's Theorem for arbitrary products, Stone-Cech compactification, applications of the Tychnoff theorem, Local finiteness, paracompactness, metrizable space, metrization theorem, the Nagata-Smirnov metrization theorem and the Smirnov metrization theorem. Problems and exercise based on these concepts.

Unit-III

Complete Metric Spaces, uniform metric, sup metric, Completeion of metric space, a space-filling curve, compactness in metric spaces, equicontinuity, classical version of Ascoli's theorem, pointwise and compact convergence, evaluation map, Ascoli's theorem. Problems and exercise based on these concepts.

Course Code : UMJMAT – 806
Course Title : Topology – II

Unit-IV

Baire spaces, the Baire category theorem, applications of the Baire category theorem, a nowhere-differentiable function, m-manifolds, topological dimension, imbedding theorem. Problems and exercise based on these concepts.

Text Books:

1. J. R. Munkres, *Topology*, Pearson Education India, 2013.

Reference Books:

1. J. R. Munkres, *Topology of Manifolds*, Westview Press, 1991.
2. S. Willard, *General Topology*, Addison Wesley, 1970.
3. G. F. Simmons, *Introduction to Topology and Modern Analysis*, McGraw-Hill Education, 1963.
4. G. E. Bredon, *Topology and Geometry*, Springer, 1993.
5. J. Dugundji, *Topology,* Allyn and Bacon, 1966.
6. J. L. Kelly, *General Topology,* Springer Science and Business Media, 1975.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VIII
(Examination to be held in May 2026, 2027, 2028)
Minor Course

Course Code: UMIMAT-807
Course Title: Partial Differential Equation
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course aims at understanding the concept of partial differential equation and its relevance in discribing a physical phenomenon such as diffusion and wave equation and to learn separation of variable method to solve parabolic, elliptic and hyperbolic equation.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Introduction to Partial Differential Equations, order and degree of a partial differential equation, Formation of a partial differential equation by eliminating arbitrary constants and functions, types of partial differential equations, Lagrange's method of solving partial differential equation of order one. Problems and Exercises based on these topics to be done as tutorials.

Unit-II

Non linear partial differential equation of degree one. Complete integral, singular integral, general solution, Charpit's method and solution of equation of the type $f(p,q) = 0$, $z = p + q + f(p,q)$ and $f(x,p) = g(y,q)$. Problems and Exercises based on these topics to be done as tutorials.

Unit-III

Homogeneous and Non-Homogenous linear partial differential equations of 2nd and 3rd order with constant coefficients of the type $F(D,D') = g(x,y)$, where $g(x,y) = 0$, $e^{(}ax+by)$, $Cos(ax+by)$, $sin(ax+by)$, $f(ax+by)$, $x^m y^n$, $Ve^{(}ax+by)$. Homogeneous partial differential equation of the type $[(D + m_1D')(D + m_2D')(D + m_3D')]z = f(x,y)$. Problems and Exercises based on these topics to be done as tutorials.

Course Code : UMIMAT – 807
Course Title : Partial Differential Equation

Unit-IV

Classification of second order partial differential equation, Canonical forms, Canonical form of hyperbolic, parabolic and elliptic equations. Solutions of heat and wave equations by separation of variables, Dirchlet problem for a rectangle. Problems and Exercises based on these topics to be done as tutorials.

Text Books:

1. I. N. Sneddon, *Elements of partial differential equations,* McGraw-Hill International Editions.

Reference Books:

1. K. Sankara Rao, *Introduction to partial differential equation,* Prentice Hall of India Pvt. Ltd. 2007
2. M. D. Raisinghania, *Ordinary and partial differential equations,* S. Chand and co. 2020

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

Research:

<table>
<tr><th>S. No.</th><th>Course Type</th><th>Course No.</th><th>Course Title</th><th>Credits</th><th colspan="4">Marks</th><th>Total Marks</th></tr>
<tr><td>1.</td><td>Major</td><td colspan="8">The candidate has to opt any one major course of credits 4 out of the six major courses.</td></tr>
<tr><td rowspan="2">2.</td><td rowspan="2">Minor</td><td rowspan="2">UMIMAT- 807</td><td rowspan="2">Partial Differential equation</td><td rowspan="2">4</td><td colspan="2">Theory</td><td colspan="2">Tutorial</td><td rowspan="2">100</td></tr>
<tr><td>Mid Semester Examination: 15 Marks</td><td>End Semester Examination: 60 Marks</td><td>Continuous Assessment: 10 Marks</td><td>Final Exam: 15 Marks</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td colspan="2">Dissertation (8-Credits)</td><td colspan="2">Viva (4-Credits)</td><td></td></tr>
<tr><td>3.</td><td>SE</td><td>USEMAT-808</td><td>Dissertation</td><td>12</td><td colspan="2">200</td><td colspan="2">100</td><td>300</td></tr>
</table>

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VIII
(Examination to be held in May 2026, 2027, 2028)
Minor Course

Course Code: UMIMAT-807
Course Title: Partial Differential Equation
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, **Theory:** 75, **Tutorial:** 25

Objectives: This course aims at understanding the concept of partial differential equation and its relevance in discribing a physical phenomenon such as diffusion and wave equation and to learn separation of variable method to solve parabolic, elliptic and hyperbolic equation.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Introduction to Partial Differential Equations, order and degree of a partial differential equation, Formation of a partial differential equation by eliminating arbitrary constants and functions, types of partial differential equations, Lagrange's method of solving partial differential equation of order one. Problems and Exercises based on these topics to be done as tutorials.

Unit-II

Non linear partial differential equation of degree one. Complete integral, singular integral, general solution, Charpit's method and solution of equation of the type $f(p,q) = 0$, $z = p + q + f(p,q)$ and $f(x,p) = g(y,q)$. Problems and Exercises based on these topics to be done as tutorials.

Unit-III

Homogeneous and Non-Homogenous linear partial differential equations of 2nd and 3rd order with constant coefficients of the type $F(D,D') = g(x,y)$, where $g(x,y) = 0$, $e^{(}ax+by)$, $Cos(ax+by)$, $sin(ax+by)$, $f(ax+by)$, $x^m y^n$, $Ve^{(}ax+by)$. Homogeneous partial differential equation of the type $[(D + m_1D')(D + m_2D')(D + m_3D')]z = f(x,y)$. Problems and Exercises based on these topics to be done as tutorials.

Course Code : UMIMAT – 807
Course Title : Partial Differential Equation

Unit-IV

Classification of second order partial differential equation, Canonical forms, Canonical form of hyperbolic, parabolic and elliptic equations. Solutions of heat and wave equations by separation of variables, Dirchlet problem for a rectangle. Problems and Exercises based on these topics to be done as tutorials.

Text Books:

1. I. N. Sneddon, *Elements of partial differential equations,* McGraw-Hill International Editions.

Reference Books:

1. K. Sankara Rao, *Introduction to partial differential equation,* Prentice Hall of India Pvt. Ltd. 2007
2. M. D. Raisinghania, *Ordinary and partial differential equations,* S. Chand and co. 2020

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER VIII
(Examination to be held in May 2026, 2027, 2028)
Skill Enhancement Course

Course Code: USEMAT-808
Course Title: Dissertation
Credits: 12
Maximum Marks: 300
Dissertation: 08 credits (200 marks)
Viva/presentation: 04 credits (100 marks)

Objectives :

Project work is considered a unique course involving applying knowledge in solving/ analyzing/ exploring a real-life situation/ complex problem/ data analysis. Project work has the intention to provide research competencies at the undergraduate level. It enables the acquisition of special/advanced knowledge through support study/a project work. This course is applicable to students in 8th semester of undergraduate research program.

Guidelines :

The following mechanism shall be adopted for completion of the project:

1. Admission to Honours with Research Programme (4th year, 7th Semester) shall be on the basis of the cumulative score (75% marks and above in the first five semesters) and subject to availability of permanent faculty with doctoral degree and infrastructure and number of seats in the College.
2. Research Project work (12 credits) shall be started at the beginning of 7th Semester,
3. There shall be a Project Synopsis in the programme based on the major area/subject. The permanent faculty with Ph.D. and research experience (as per UGC guidelines) shall be the research project supervisor after being recognized by the Departmental Research Committee (DRC) of the Nodal Department.
4. The college offering FYUGP with Research should have its own College Research Committee (CRC) for each discipline with at least one member from any University of the region.
5. The project report/dissertation shall be evaluated by the external expert from other University/Colleges to be nominated by the Principal out of the panel supplied by the CRC.
6. Project proposal to be scrutinized by the College Research Committee for the concerned subject.
7. Evaluation of Dissertation shall be offline and Viva-Voce shall be either offline or online as per the convenience of the examiner.

Note : A separate guideline shall be issued with regard to the payment of remuneration to the external expert for evaluation.