PANJAB UNIVERSITY, CHANDIGARH-160014 (INDIA)

(Estd. under the Panjab University Act VII of 1947—enacted by the Govt. of India)

FACULTY OF SCIENCE

SYLLABI

FOR

M.Sc. MATHEMATICS (1st & 2nd Semester) EXAMINATIONS, 2011-2012

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APPLICABILITY OF REGULATIONS FOR THE TIME BEING IN FORCE

Notwithstanding the integrated nature of a course spread over more than one academic year, the regulations in force at the time a student joins a course shall hold good only for the examinations held during or at the end of the academic year. Nothing in these regulations shall be deemed to debar the University from amending the regulations subsequently and the amended regulations, if any, shall apply to all students whether old or new.

GUIDELINES FOR CONTINUOUS INTERNAL ASSESSMENT (20%) FOR REGULAR STUDENTS OF POST-GRADUATE COURSES OF M.Sc. Mathematics (Semester System)

(Effective from the First Year Admission for the Academic Session 2007-2008)

1. The Syndicate has approved the following guidelines, mode of testing and evaluation including Continuous Internal Assessment of students :

   (i) Terminal Evaluation : 80 %

   (ii) Continuous Assessment : 20 %

   (iii) Continuous Assessment may include written assignment, snap tests, participation in discussions in the class, term papers, attendance etc.

   (iv) In order to incorporate an element of Continuous Internal Assessment of students, the Colleges/Departments will conduct **one** written test and one snap test as quantified below :

(a)	Written Test	:	25 (reduced to 5)
(b)	Snap Test	:	25 (reduced to 5)
(c)	Participation in Class discussion	:	15 (reduced to 3)
(d)	Term Paper	:	25 (reduced to 5)
(e)	Attendance	:	10 (reduced to 2)
		Total :	**100 reduced to 20**

2. Weightage of 2 marks for attendance component out of 20 marks for Continuous Assessment shall be available only to those students who attend 75% and more of classroom lectures/seminars/workshops. The break–up of marks for **attendance component** for theory papers shall be as under :

Attendance Component			*Mark/s for Theory Papers*
(a)	75 % and above upto 85 %	:	1
(b)	Above 85 %	:	2

3. It shall not be **compulsory** to pass in Continuous Internal Assessment. Thus, whatever marks are secured by a student out of 20% marks, will be carried forward and added to his/her score out of 80 % i.e. the remaining marks allocated to the particular subject and, thus, he/she shall have to secure pass marks both in the University examinations as well as total of Internal Continuous Assessment and University examinations.

4. Continuous Internal Assessment awards from the affiliated Colleges/Departments must be sent to the Controller of Examinations, by name, **two weeks before** the commencement of the particular examination on the *proforma* obtainable from the Examination Branch.

SPECIAL NOTE :

(i) The theory question paper will be of 80 marks and 20 marks will be for internal assessment.

(ii) In the case of Postgraduate Course in the Faculties of Arts, Science, Languages, Education, Design & Fine Arts, and Business Management & Commerce (falling under the purview of Academic Council), where such a provision of Internal Assessment/Continuous Assessment already exists, the same will continue as before.

PANJAB UNIVERSITY, CHANDIGARH

OUTLINES OF TESTS, SYLLABI AND COURSES OF READING FOR SEMESTER I & II of M.Sc. (PASS COURSE) IN MATHEMATICS FOR THE ACADEMIC SESSION 2011-12

Outlines of Tests

M.Sc. (Pass Course) in Mathematics

SEMESTER-I

MATH-601S	:	Real Analysis-I
MATH-602S	:	Algebra-I
MATH-603 S	:	Differential Equations
MATH-604 S	:	Complex Analysis-I
MATH-605 S	:	Number Theory-I

SEMESTER-II

MATH-621S	:	Real Analysis-II
MATH-622S	:	Algebra-II
MATH-623 S	:	Vector analysis and Mechanics
MATH-624 S	:	Complex Analysis-II
MATH-625 S	:	Number Theory-II

SEMESTER-I

MATH 601S : Real Analysis-I

Total Marks	:	100
Theory	:	80 Marks
Internal Assessment	:	20 Marks
Time	:	3 hrs.

Note :

1. The question paper will consist of 9 questions. Candidates will attempt total five questions.
2. Question No.1 is compulsory and will consist of short answer type questions covering the whole syllabus.
3. There will be four questions from each Unit and the candidates will be required to attempt two questions from each Unit.
4. All questions carry equal marks.

UNIT-I

(i) **Basic Topology :** Finite, countable and uncountable sets. Metric spaces, compact sets. Perfect sets. Connected sets.

(ii) **Sequences and Series :** Convergent sequences (in metric spaces). Subsequences. Cauchy sequences. Upper and lower limits of a sequence of real numbers. Riemann's Theorem on Rearrangements of series of real and complex numbers.

(iii) **Continuity :** Limits of functions (in metric spaces). Continuous functions. Continuity and compactness. Continuity and connectedness. Monotonic functions.

UNIT-II

(iv) **The Riemann-Stieltjes Integral :** Definition and existence of the Riemann-Stieltjes integral. Properties of the integral. Integration of vector-valued functions. Rectifiable curves.

(v) **Sequences and Series of Functions :** Problem of interchange of limit processes for sequences of functions. Uniform convergence. Uniform convergence and continuity. Uniform convergence and integration. Uniform convergence and differentiation. Equicontinuous families of functions, The Stone-Weierstrass theorem.

Scope

As in relevant sections of Chapters 2,3,4,6,7 of the book at Sr. No. 6 in the list of references.

References :

1. Apostol, Tom, Mathematical Analysis - A Modern Approach to Advanced Calculus, Addison - Wesley Publishing Company, Inc. 1987. (Indian Edition by Narosa Publishing House, New Delhi also available).

2. Bromwich, T.J.I.A., An Introduction to the Theory of Infinite Series. Second edition (Revised with the assistance of T.M.Mac Robert). Macmillan and Co. Ltd., New York, 1955.

3. Goldberg, R.R., Methods of Real Analysis, Oxford and IHB Publishing Company, New Delhi.

4. Knopp, K., Theory and Applications of Infinite Series, Blackie and Sons Ltd., London and Glasgow, Second Edition, 1951 (Reprinted 1957).

5. Malik, S.C., Mathematical Analysis, Wiley Eastern, New Delhi, 1984.

6. Rudin, Walter, Principles of Mathematical Analysis, Third Edition (International Student Edition) McGraw-Hill Inc., 1983.

7. Shanti Narayan, A Course of Mathematical Analysis, S. Chand and Co. Ltd., New Delhi, Twelfth Revised Edition, 1986.

8. Titchmarsh, E.C., The Theory of Functions, Second Edition, The English Language Book Society and Oxford University Press, 1961.

Math 602S : Algebra-I

Total Marks	:	100
Theory	:	80 Marks
Internal Assessment	:	20 Marks
Time	:	3 hrs.

Note :

1. The question paper will consist of 9 questions. Candidates will attempt total five questions.
2. Question No.1 is compulsory and will consist of short answer type questions covering the whole syllabus.
3. There will be four questions from each Unit and the candidates will be required to attempt two questions from each Unit.
4. All questions carry equal marks.

UNIT-I

Review of basic concepts of groups with emphasis on exercises. Permutation groups, Even and odd permutations, Conjugacy classes of permutations, Alternating groups, Simplicity of An, $n > 4$. Cayley's Theorem, Direct products, Fundamental Theorem for finite abelian groups, Sylow theorems and their applications, Finite Simple groups [Scope as in chapters 2-4 Modern Algebra by Surjeet Singh and Qazi Zameerudin, Eighth Edition and chapters 11, 24, 25 of Contemporary Abstract Algebra by Gallian, Fourth Edition]

UNIT-II

Survey of some finite groups, Groups of order p^2, pq (p and q primes). Solvable groups, Normal and subnormal series, composition series, the theorems of Schreier and Jordan Holder [Scope as in Chapters 6 of Modern Algebra by Surjeet Singh and Qazi Zameerudin, Eighth Edition and Chapter 7 of Algebra, Vol. I by Luther and Passi].

Review of basic concepts of rings with emphasis on exercises. Polynomial rings, formal power series rings, matrix rings, the ring of Guassian Integers. [Scope as in Chapters 7, 8 and 9 of Modern Algebra by Surjeet Singh and Qazi Zameerudin, Eighth Edition , 2006].

References :

1. Luthar, I.S. and Passi, I.B.S., *Algebra*, Vol. I & II, Narosa Publishing House, New Delhi.

2. Gallian, J.A, *Contemporary Abstract Algebra,* Narosa Publishing House, New Delhi.

3. Singh, Surjeet and Qazi Zameeruddin, *Modern Algebra,* Vikas Publishing House, New Delhi (8^{th} Edition) 2006.

4. Herstein, I.N., *Topics in Algebra* (Second Edition), Wiley Eastern Limited, New Delhi.

5. Musili, C., *Rings and Modules* (Second Revised Edition), Narosa Publishing House, New Delhi, 1994.

6. Artin, M., *Algebra*, Prentice Hall of India, New Delhi, 1994.

7. Bhattacharya, P.B.; Jain, S.K.; and Nagpal, S.R., *Basic Abstract Algebra,* Cambridge University Press, New Delhi.

8. Burnside, W., *The Theory of Groups of Finite Order (2^{nd} Ed.),* Dover, New York, 1955.

9. Fraleigh J.B., *A First Course in Abstract Algebra,* Narosa Publishing House, New Delhi.

10. Hartley, B. and Hawkes, T.O., *Rings, Modules and Linear Algebra,* Chapman and Hall.

11. Hungerford, T.W., *Algebra,* Springer, 1974.

Math 603S : Differential Equations

Total Marks	:	100
Theory	:	80 Marks
Internal Assessment	:	20 Marks
Time	:	3 hrs.

Note :
1. The question paper will consist of 9 questions. Candidates will attempt total five questions.
2. Question No.1 is compulsory and will consist of short answer type questions covering the whole syllabus.
3. There will be four questions from each Unit and the candidates will be required to attempt two questions from each Unit.
4. All questions carry equal marks.

UNIT-I

Differential Equations

Existence and uniqueness of solution of first order equations. Boundary value problems and Strum-Liouville theory. ODE in more than 2-variables.

[Scope as in Chapter V of the book 'An Introduction to Ordinary Differential Equations' by E.A.Coddington and Chapters X & XI of the book 'Elementary Differential Equations and Boundary Value Problems' by W.E.Boyce and R.C.Diprima.]

UNIT-II

Partial differential equations of first order. Partial differential equations of higher order with constant co-efficients. Partial differential equations of second order and their classification.

[Scope as in Chapters I, II & III of the book 'Elements of Partial Differential Equations' by I.N.Sneddon].

References :

1. Coddington, E.A., An Introduction to Ordinary Differential Equations, Ch. V., Prentice Hall of India Pvt. Ltd., New Delhi, 1987.
2. Boyce, W.E. and Diprima, R.C., Elementary Differential Equations and Boundary Value Problems, Ch. X, XI, 4th Edition, John Wiley and Sons, USA.
3. Sneddon, I.N., Elements of Partial Differential Equations, Ch. I, II, III, McGraw Hill, 1957.
4. Tyn Mying-U, Differential Equations of Mathematical Physics.

Math 604S : Complex Analysis-I

Total Marks	:	100
Theory	:	80 Marks
Internal Assessment	:	20 Marks
Time	:	3 hrs.

Note :

1. The question paper will consist of 9 questions. Candidates will attempt total five questions.
2. Question No.1 is compulsory and will consist of short answer type questions covering the whole syllabus.
3. There will be four questions from each Unit and the candidates will be required to attempt two questions from each Unit.
4. All questions carry equal marks.

UNIT-I

Complex plane, geometric representation of complex numbers, joint equation of circle and straight line, stereographic projection and the spherical representation of the extended complex plane. Topology on the complex plane, connected and simply connected sets. Complex valued functions and their continuity. Curves, connectivity through polygonal lines.

Analytic functions, Cauchy-Riemann equations, Harmonic functions and Harmonic conjugates.

Power series, exponential and trigonometric functions, arg z, log z, a^z and their continuous branches.

(Scope as in "Theory of Functions of a Complex Variable" by Shanti Narain, Chapter 1, 2, §39-44 and §47-50, 53, 54 of Chapter 4, §59-64 of Chapter 5., §79-88 of Chapter 6).

UNIT-II

Complex Integration, line integral, Cauchy's theorem for a rectangle, Cauchy's theorem in a disc, index of a point with respect to a closed curve, Cauchy's integral formula, Higher derivatives, Morrera's theorem, Liouville's theorem, fundamental theorem of Algebra, Maximum Modules principle, Schwarz Lemma. The general form of Cauchy's theorem. Taylor series and Laurent series. (Scope as in "Complex Analysis" by D. V. Ahlfors, Chapter 4, §1, 2 §4.1 to 4.5 and §5.1 and the book "Theory of Functions Complex Variable" by Shanti Narain, and in "Theory of Functions Complex Variable" by Shanti Narain, §111-113, §117-118 of Chapter 9)

References :

1. Shanti Narayan, Theory of Functions of a Complex Variable, S. Chand and Co. (Seventh Edition, 1986).
2. Ahlfors, D.V., Complex Analysis, Third Edition (International student edition), McGraw-Hill International Book Company.
3. Conway, J.B., Function of One Complex Variable, Second Edition, 1978, Corr 4^{th} Print 1986 Graduate Texts, Springer-Verlag, Indian edition by Narosa Publising House, New Delhi.
4. Copson, E. T., An Introduction to the Theory of Functions of a Complex Variable, The English Language Book Society and Oxford University Press, 1985.
5. Knopp, K., Theory of Functions, (Translated by F. Bagemite) in Two Volumes, Dover Publications, Inc., New York, 1945, 1947.
6. Pati, T., Functions of a Complex Variable, Allahabad, Pothishala, 1971.
7. Saks, S. and Zygmund, A., Analytic Functions (Translated by E. J. Scott) Poland, Warszawa, 1952.
8. Silverman, R., Introductory Complex Analysis, Prentice-Hall Inc., Englewood Cliffs, N.J., 1967.
9. Deshpande, J.V., Complex Analysis, Tata McGraw-Hill Publishing Company Ltd., 1989.
10. Tichmarsh, E.C., The Theory of Functions, the English Language Book Society and Oxford University Press, Second Edition, 1961.
11. Tutschke Wolfgang and Vasudeva, Harkrishan L., An Introduction to Complex Analysis, Classical and Modern Approaches, Chapman and Hall/CRC, 2005.
12. Ponnusamy, S., Foundations of Complex Analysis by Narosa Publising House, New Delhi.

MATH-605S : Number Theory-1

Total Marks	:	100
Theory	:	80 Marks
Internal Assessment	:	20 Marks
Time	:	3 hrs.

Note :
1. The question paper will consist of 9 questions. Candidates will attempt total five questions.
2. Question No.1 is compulsory and will consist of short answer type questions covering the whole syllabus.
3. There will be four questions from each Unit and the candidates will be required to attempt two questions from each Unit.
4. All questions carry equal marks.

UNIT-I

Divisibility, Greatest common divisor, Euclidean Algorithm, The Fundamental Theorem of arithmetic, congruences, Special divisibility tests, Chinese remainder theorem, Fermat's little theorem, Wilson's theorem, residue classes and reduced residue classes, Euler's theorem, An Application to cryptography, Arithmetic functions $\phi(n)$, $d(n)$, $\sigma(n)$, $\mu(n)$, Mobius inversion Formula, the greatest integer function, perfect numbers, Mersenne primes and Fermat numbers.

UNIT-II

Primitive roots and indices. Quadratic residues, Legendre symbol, Quadratic reciprocity law, Jacobi symbol, Binary quadratic forms and their reduction, sums of two and four squares, positive definite binary quadratic forms, Diophantine equations $ax + by = c$, $x^2+y^2=z^2$, $x^4+y^4=z^2$.

[Scope as in Chapters 2-8, 10 of 'Elementary Number Theory', 2nd Edition, by David M. Burton, Chapters 3, 5(sections 5.1, 5.3, 5.4) of 'Introduction to the Theory of Numbers', 5th Edition, by Niven, Zuckerman & Montgomery.]

References :

1. David. M. Burton : Elementary Number Theory, 2nd Edition (UBS Publishers).
2. Niven, Zuckerman & Montgomery : Introduction to Theory of Numbers, 5th Edition (John Wiley & Sons).
3. Davenpart H : Higher Arithmetic (Camb. Univ. Press).
4. Hardy & Wright : Number Theory (Oxford Univ. Press).
5. Dence J. B & Dence T.P : Elements of the Theory of Numbers (Academic Press).

SEMESTER-II

MATH-621S : Real Analysis-II

Total Marks	:	100
Theory	:	80 Marks
Internal Assessment	:	20 Marks
Time	:	3 hrs.

Note :

1. The question paper will consist of 9 questions. Candidates will attempt total five questions.
2. Question No.1 is compulsory and will consist of short answer type questions covering the whole syllabus.
3. There will be four questions from each Unit and the candidates will be required to attempt two questions from each Unit.
4. All questions carry equal marks.

UNIT-I

(i) **Differentiation :** Differentiation of vector-valued functions.

(ii) **Functions of Several Variables :** The space of linear transformations on R^n to R^m as a metric space. Differentiation of a vector-valued function of several variables. The Inverse function theorem. The implicit function theorem.

(iii) **Lebesgue Measure :** Introduction. Outer measure. Measurable sets and Lebesgue measure. A non-measurable set. Measurable functions. Littlewood's three principles.

UNIT-II

(iv) **The Lebesgue Integral :** The Lebesgue integral of a bounded function over a set of finite measure. The integral of a non-negative function. The general Lebesgue integral. Convergence in measure.

(v) **Differentiation and Integration:** Differentiation of monotone functions. Differentiation of an integral. Absolute continuity. Convex functions

Scope

(i) For items (i) & (ii) as in relevant sections of Chapters 5 &9 of the book at Sr. No. 5 in the list of references.

(ii) For items (iii) to (v) as in relevant sections of Chapters 3 to 5 of the book at Sr. No. 4 of references.

References :

1. Apostol, Tom, Mathematical Analysis, A Modern Approach to Advanced Calculus, Addison - Wesley Publishing Company, Inc. 1987. (Indian Edition by Narosa Publishing House, New Delhi also available).

2. Goldberg, R.R., Methods of Real Analysis, Oxford and IHB Publishing Company, New Delhi.

3. Malik, S.C., Mathematical Analysis, Wiley Eastern, New Delhi, 1984.

4. Royden, H.L., Real Analysis, Macmillan and Co. Ltd., New York, Second Edition, 1968, New York, Third Edition, 2009.

5. Rudin, Walter, Principles of Mathematical Analysis, Third Edition (International Student Edition) McGraw-Hill Inc., 1983.

Math 622S : Algebra-II

Total Marks	:	100
Theory	:	80 Marks
Internal Assessment	:	20 Marks
Time	:	3 hrs.

Note : 1. The question paper will consist of 9 questions. Candidates will attempt total five questions.

2. Question No.1 is compulsory and will consist of short answer type questions covering the whole syllabus.

3. There will be four questions from each Unit and the candidates will be required to attempt two questions from each Unit.

4. All questions carry equal marks.

UNIT-I

Factorization Theory in Integral Domains, Divisibility, Unique factorization Domain (UFD), Principal Ideal Domain (PID), Euclidian Domain (ED) and their relationships. Noetherian and Artinian Rings, Examples and Counter Examples, Artinian Rings without zero divisors, Nil Ideals in Artinian Rings, Hilbert Basis Theorem. [Scope as in Chapters 10 and 15 of Modern Algebra by Surjeet Singh and Qazi Zameerudin, Eighth Edition , 2006].

UNIT-II

Modules, Difference between Modules and Vector Spaces, Module Homomorphisms, Quotient Module, Completely reducible or Semisimple Modules, Free Modules, Representation and Rank of Linear Mappings, Smith normal Form over a PID, Finitely generated modules over a PID, Rational Canonical Form, Applications to finitely generated abelian groups [Scope as in Chapters 14. 20 and 21 (Sections 1, 2, 3, 4) of Basic Abstract Algebra by P.B.Bhattacharya, S.K.Jain, and S.R.Nagpal, Cambridge University Press, 1986].

References :

1. Luthar, I.S. and Passi, I.B.S., *Algebra*, Vol. II & III, Narosa Publishing House, New Delhi.

2. Gallian, J. A., *Contemporary Abstract Algebra,* Narosa Publishing House, New Delhi.

3. Singh, Surjeet and Qazi Zameeruddin, *Modern Algebra,* Vikas Publishing House, New Delhi (8^{th} Edition) 2006.

4. Herstein, I. N., *Topics in Algebra* (Second Edition), Wiley Eastern Limited, New Delhi.

5. Musili, C., *Rings and Modules* (Second Revised Edition), Narosa Publishing House, New Delhi, 1994.

6. Artin, M., *Algebra*, Prentice Hall of India, New Delhi, 1994.

7. Bhattacharya, P.B.; S.K. Jain; and S.R. Nagpal, *Basic Abstract Algebra,* Cambridge University Press, New Delhi.

8. Burnside, W., *The Theory of Groups of Finite Order (2^{nd} Ed.),* Dover, New York, 1955.

9. Fraleigh, J.B., *A First Course in Abstract Algebra,* Narosa Publishing House, New Delhi.

10. Hartley, B and Hawkes, T.O., *Rings, Modules and Linear Algebra,* Chapman and Hall.

11. Hungerford, T.W., *Algebra,* Springer, 1974.

Math 623S : Vector Analysis and Mechanics

Total Marks	:	100
Theory	:	80 Marks
Internal Assessment	:	20 Marks
Time	:	3 hrs.

Note :

1. The question paper will consist of 9 questions. Candidates will attempt total five questions.
2. Question No.1 is compulsory and will consist of short answer type questions covering the whole syllabus.
3. There will be four questions from each Unit and the candidates will be required to attempt two questions from each Unit.
4. All questions carry equal marks.

UNIT-I

Vectors

Scalar and vector point functions, Differentiation and integration of vectors, Gradient divergence and curl operators, Green's and Stoke's theorems, Gauss' divergence theorem, Curvilinear co-ordinates.

[Scope as in Chapters VI & VII of the book 'A Text Book of Vector Calculus' by Shanti Narayan and J. N. Kapur, 1996, S. Chand & Company Ltd., New Delhi.]

UNIT-II

Mechanics

Generalized co-ordinates. Lagrange's equations. Hamilton's canonical equations. Hamilton's principle of least action. Reduction to the equivalent one body problem. The equations of motion and first integral. The equivelent one-dimensional problem and classification of orbits. The Viral theorem. Rigid body motion about an axis. Moving axis.

[Scope as in Chapters I-V and VIII of the book 'Classical Mechanics' by H. Goldstein, C. Poole and J. Safko, 3rd Edition, Addison Wesley (2002)].

References :

1. Weatherburn, C.E., Advanced Vector Analysis.
2. Goldstein, H., Poole, C. and Safko, J., *Classical Mechanics,* 3rd Edition, Addison Wesley (2002).
3. Schaum Series, *Vector Analysis.*
4. Shanti Narayan and J. N. Kapur, *A Text Book of Vector Calculus,* 1996, S. Chand &Company Ltd., New Delhi.

MATH 624S : Complex Analysis-II

Total Marks	:	100
Theory	:	80 Marks
Internal Assessment	:	20 Marks
Time	:	3 hrs.

Note :
1. The question paper will consist of 9 questions. Candidates will attempt total five questions.
2. Question No.1 is compulsory and will consist of short answer type questions covering the whole syllabus.
3. There will be four questions from each Unit and the candidates will be required to attempt two questions from each Unit.
4. All questions carry equal marks.

UNIT-I

Singularities, Cauchy's residue theorem. Calculus of residues, bilinear transformations. Definitions and examples of conformal mappings. Zeros and poles of meromorphic functions, Rouche's theorem, Argument Principle.

UNIT-II

Infinite products, Weierstrass theorem, Mittagleffer's theorem, Canonical product, Analytic Continuation through power series(basic ideas), Natural boundary, the Gamma function and Riemann Zeta function.

(Scope as in "Complex Analysis" by D. V. Ahlfors Chapter 5 §2.3, 2.4, 4.1, 4.2, and in "Theory of Functions Complex Variable" by Shanti Narain, Chapter 3, §65-67 of Chapter 5, Chapter 7 §120-129 of Chapter 10, §130-136 of Chapter 11)

References :

1. Shanti Narayan, *Theory of Functions of a Complex Variable,* S. Chand and Co. (Seventh Edition, 1986).
2. Ahlfors, D.V., *Complex Analysis,* Third Edition (International student edition) McGraw-Hill International Book Company.
3. Conway, J.B., *Function of One Complex Variable,* Second Edition, 1978, Corr 4th Print 1986, Graduate Texts, Springer-Verlag, Indian Edition by Narosa Publising House, New Delhi.
4. Copson, E. T., *An Introduction to the Theory of Functions of a Complex Variable,* The English Language Book Society and Oxford University Press, 1985.
5. Knopp, K., *Theory of Functions* (translated by F. Bagemite) in Two Volumes, Dover Publications, Inc.New York 1945, 1947.
6. Pati, T., *Functions of a Complex Variable,* Allahabad Pothishala, 1971.
7. Saks, S., and Zygmund, A., *Analytic Functions* (Translated by E. J. Scott) Poland, Warszawa, 1952.
8. Silverman, R., *Introductory Complex Analysis,* Prentice-Hall Inc. Englewood Cliffs, N.J., 1967.
9. Deshpande, J.V., *Complex Analysis*, Tata McGraw-Hill Publishing Company Ltd., 1989.
10. Tichmarsh, E.C., *The Theory of Functions,* The English Language Book Society and Oxford University Press, second edition, 1961.
11. Tutschke Wolfgang and Vasudeva, Harkrishan L., *An Introduction to Complex Analysis, Classical and Modern Approaches,* Chapman and Hall/CRC, 2005.
12. S. Ponnusamy, Foundations of Complex Analysis, Narosa Publising House, New Delhi.

MATH-625 : Number Theory-II

Total Marks	:	100
Theory	:	80 Marks
Internal Assessment	:	20 Marks
Time	:	3 hrs.

Note :

1. The question paper will consist of 9 questions. Candidates will attempt total five questions.
2. Question No.1 is compulsory and will consist of short answer type questions covering the whole syllabus.
3. There will be four questions from each Unit and the candidates will be required to attempt two questions from each Unit.
4. All questions carry equal marks.

UNIT-I

Farey sequences, Continued fractions, Approximation of reals by rationals**,** Pell's equations, Minkowski's theorem in Geometry of Numbers and its applications.

[Scope as in 6 & 7 of 'Introduction to the Theory of Numbers', 5th Edition, by Niven, Zuckerman & Montgomery.]

UNIT-II

Partitions [Scope as in Chapter 10 of 'Theory of Numbers, 5th Edition, by Niven, Zuckerman & Montgomery], Order of magnitude and average order of arithmetic functions, Euler summation formula, Abel's Identity, Elementary results on distribution of primes.

[Scope as in Chapters 3 & 4 of 'Introduction to Analytic Number theory' by T. M. Apostol.]

References :

1. David, M. Burton : Elementary Number Theory, 2nd Edition (UBS Publishers).
2. Niven, Zuckerman & Montgomery : Introduction to Theory of Numbers, 5th Edition(John Wiley & Sons).

3.	Apostol, T. M.	:	Introduction to Analytic Number Theory (Springer-Verlag).
4.	Davenpart, H.	:	Higher Arithmetic (Camb. Univ. Press).
5.	Hardy & Wright	:	Number Theory (Oxford Univ. Press).
6.	Dence, J.B. & Dence, T.P.	:	Elements of the Theory of Numbers (Academic Press).

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