Dr. B. R. AMBEDKAR UNIVERSITY, SRIKAKULAM

General Regulations relating to

POST GRAUDATE AND PROFESSIONAL COURSES
Syllabus under Credit Based Semester System

(with effect from 2009-2010)

1. Candidates seeking admission for the Masters/Professional Degree Courses shall be required to have passed the qualifying examination prescribed for the course of any University recognized by Dr. B.R. Ambedkar University, Srikakulam as equivalent there to

2. The course and scope shall be as defined in the Scheme of Instruction and syllabus prescribed.

3. The course consists of 2/4/6 semesters, @ two semesters/year, unless otherwise specified.

4. The candidates shall be required to take an examination at the end of each semester of the study as detailed in the Scheme of Examination. Each semester theory paper carries a maximum of 100 marks, of which 85 marks shall be for semester-end theory examination of the paper of three hours duration and 15 marks shall be for internal assessment

4. (a) Internal Assessment for 15 Marks: Two mid-term exams, one conventional (descriptive) and the second – 'on-line' with multiple choice questions for each theory paper shall be conducted. The average of these two mid-term exams shall be taken as marks obtained for the paper under internal assessment. If any candidate appears for only one mid-term exam, the average mark, dividing by two shall be awarded. If any candidate fails to appear for both the mid term exams of a paper, only marks obtained in the theory paper shall be taken into consideration for declaring the result. Each mid-term exam shall be conducted only once.

4. (b) Candidates shall be declared to have passed each theory paper if he/she obtains not less than E Grade ie., an aggregate of 40 % of the total marks inclusive of semester-end and internal assessment marks in each paper.

5. A candidate appearing for the whole examination shall be declared to have passed the examination if he/she obtains a Semester Grade Point (SGP) of 5.0 and a CGPA of 5.0 to be declared to have passed the Course.

6. Not withstanding anything contained in the regulations, in the case of Project Report/Dissertation/ Practical/Field Work/Viva-voce etc., candidates shall obtain not less than D grade, i.e., 50% of marks to be declared to have passed the examination.

7. ATTENDANCE: Candidates shall put in attendance of not less than 75% of attendance, out of the total number of working periods in each semester. Only such candidates shall be allowed to appear for the semester-end examination.

7. (a) A candidate with attendance between 74.99% and 66.66% shall be allowed to appear for the semester-end examination and continue the next semester only on medical and other valid grounds, after paying the required condonation fee.

7. (b) In case of candidates who continuously absent for 10 days without prior permission on valid grounds, his/her name shall automatically be removed from the rolls.

7 (c) If a candidate represents the University at games, sports or other officially organized extra-curricular activities, it will be deemed that he/she has attended the college on the days/periods

8 Candidates who put in a minimum of 50% attendance shall also be permitted to continue for the next semester. However, such candidates have to re-study the semester course only after completion of the course period for which they are admitted. The candidate shall have to meet the course fees and other expenditure.

9 Candidates who have completed a semester course and have fulfilled the necessary attendance requirement shall be permitted to continue the next semester course irrespective of whether they have appeared or not at the semester-end examination, at their own cost.

Such candidates may be permitted to appear for the particular semester-end examination only in the following academic year; they should reregister/ reapply for the Semester examination.

The above procedure shall be followed for all the semesters

10. Candidates who appear and pass the examination in all the papers of each and every semester at first appearance only are eligible for the award of Medals/Prizes/Rank Certificates

11. BETTERMENT: Candidates declared to have passed the whole examination may reappear for the same examination to improve their SGPA, with the existing regulations without further attendance, paying examination and other fees. Such reappearance shall be permitted only with in 3 consecutive years from the date of first passing the final examination. Candidates who wish to appear thereafter should take the whole examination under the regulations then in vogue.

12. The semester-end examination shall be based on the question paper set by an external paper-setter and there shall be double valuation for post-Graduate courses. The concerned Department has to submit a panel of paper-setters and examiners approved by the BOS and the Vice-chancellor nominates the paper-setters and examiners from the panel.

13. In order to be eligible to be appointed as an internal examiner for the semester-end examination, a teacher shall have to put in at least three years of service. Relaxation of service can be exempted by the Vice-Chancellor in specific cases.

14. If the disparity between the marks awarded in the semester-end examination by internal and external examiners is 25% or less, the average marks shall be taken as the mark obtained in the

paper. If the disparity happens to be more, the paper shall be referred to another examiner for third valuation. In cases of third valuation, of the marks obtained either in the first or second valuation marks, whichever is nearest to the third valuation marks are added for arriving at the average marks.

15. Candidates can seek revaluation of the scripts of the theory papers by paying the prescribed fee as per the rules and regulations in vogue.

16. The Project Report/Dissertation/ Practical/Field Work/Viva-voce etc shall have double valuation by internal and external examiners.

17. A Committee comprising of the HOD, one internal teacher by nomination on rotation and one external member, shall conduct viva-voce examination. The department has to submit the panel, and the Vice-chancellor nominates viva-voce Committee.

18. Grades and Grade Point Details (with effect from 2009-10 admitted batches)

S. No	Range of Marks	Grade	Grade Points
1.	> 85 %	**O**	10.0
2.	75 % – 84 %	**A**	9.0
3.	67 % - 74 %	**B**	8.0
4.	58 % - 66 %	**C**	7.0
5.	50 % - 57 %	**D**	6.0
6.	40 % - 49 %	**E**	5.0
7.	< 39 %	**F (Fail)**	0.0
8.	Incomplete: (*Shall be upgraded from E to O Grade on subsequent appearance of the same semester. The corresponding Grade Points will be awarded)*	**I**	

19. Calculation of **SGPA** (Semester Grade Point Average) **& CGPA (**Cumulative Grade Point Average):

For example, if a student gets the grades in one semester A,A,B,B,B,D in six subjects having credits 2(S1), 4(S2), 4(S3), 4(S4), 4(S5), 2(S6), respectively. The SGPA is calculated as follows:

$$\textbf{SGPA} = \frac{\{9(A)x2(S1)+9(A)x4(S2)+8(B)x4(S3)+8(B)x4(S4)+8(B)x4(S5)+6(D)x2(S6)\}}{\{2(S1)+4(S2)+4(S3)+4(S4)+4(S5)+2(S6)\}} = \frac{162}{20} = 8.10$$

i. A student securing 'F' grade thereby securing 0.0 grade points has to appear and secure at least 'E' grade at the subsequent examination(s) in that subject.

ii. If a student gets the grades in another semester D, A, B, C, A, E, A, in seven subjects having credits 4(S1), 2(S2), 4(S3), 2(S4), 4(S5), 4(S6), 2(S7) respectively,

$$\textbf{SGPA} = \frac{\{6(D)x4(S1)+9(A)x2(S2)+8(B)x4(S3)+7(C)x2(S4)+9(A)x4(S5)+5(E)x4(S6)+9(A)x2(S7)\}}{\{4(S1)+2(S2)+4(S3)+2(S4)+4(S5)+4(S6)+2(S7)\}} = \frac{162}{22} = 7.36$$

$$\textbf{CGPA} = \frac{(9x2+9x4+8x4+8x4+6x2+6x4+9x2+8x4+7x2+9x4+5x4+9x2)}{(20+22)} = \frac{324}{42} = 7.71$$

a) A candidate has to secure a minimum of 5.0 SGPA for a pass in each semester in case of all PG and Professional Courses. Further, a candidate will be permitted to choose any paper(s) to appear for improvement in case the candidate fails to secure the minimum prescribed SGPA/CGPA to enable the candidate to pass at the end of any semester examination.

b) There will be no indication of pass/fail in the marks statement against each individual paper.

c) A candidate will be declared to have passed if a candidate secures 5.0 CGPA for all PG and Professional Courses.

d) The Classification of successful candidates is based on **CGPA** as follows:
   i) **Distinction** –CGPA 8.0 or more;
   ii) **First Class** –CGPA 6.5 or more but less than 8.0
   iii) **Second Class** –CGPA 5.5 or more but less than 6.5
   iv) **Pass** –CGPA 5.0 or more but less than 5.5

e) Improving CGPA for betterment of class will be continued as per the rules in vogue.

f) CGPA will be calculated from II Semester onwards up to the final semester. CGPA multiplied by “10” gives aggregate percentage of marks obtained by a candidate.

ANNEXURE – I

Eligibility

M.Sc. Degree Examination in	*Qualifying Examination for Admission*
Mathematics	B.A. / B.Sc with Mathematics as one of the subjects

ANNEXURE – II

SCHEME OF INSTRUCTION

First Semester:

Course No.	Title of the Paper	Compulsory/Elective	No.of Periods of instruction per Week
101	Algebra-I	Compulsory	6
102	Real Analysis-I	Compulsory	6
103	Topology-I	Compulsory	6
104	Differential Equations-I	Compulsory	6
105	Discrete Mathematics	Compulsory	6

Second Semester:

Course No.	Title of the Paper	Compulsory/Elective	No.of Periods of instruction per Week
201	Algebra-II	Compulsory	6
202	Real Analysis-II	Compulsory	6
203	Topology-II	Compulsory	6
204	Complex Analysis-I	Compulsory	6
205	Linear Algebra	Compulsory	6

Third Semester:

Course No.	Title of the Paper	Compulsory/Elective	No.of Periods of instruction per Week
301	Functional Analysis	Compulsory	6
302	Complex Analysis-II	Compulsory	6
303	Specialization papers (a) Number Theory-I (OR) (b) Operations Research-I	Elective	6
304	Specialization papers (a) Lattice Theory-I (OR) (b) Universal Algebra-I	Elective	6
305	Specialization papers (a) Commutative Algebra-I (OR) (b) Semigroups-I	Elective	6

Fourth Semester:

Course No.	Title of the Paper	Compulsory/Elective	No.of Periods of instruction Per Week
401	Integration Theory	Compulsory	6
402	Partial Differential Equations	Compulsory	6
403	Specialization papers (a) Number Theory-II (OR) (b) Operations Research-II	Elective	6
404	Specialization papers (a) Lattice Theory-II (OR) (b) Universal Algebra-II	Elective	6
405	Specialization papers (a) Commutative Algebra-II (OR) (b) Semigroups-II	Elective	6

In each semester each candidate has to give a lecture on a topic in each paper of Mathematics, according to the schedule given by the Department for 20 Minutes on Saturday in the SEMINAR conducted by the Department.

Candidate shall attend for a Viva –Voce conducted at the time of final examinations.

During all the four semesters the medium of instruction and writing examination is **ENGLISH** only.

Annexure - III
Scheme of Examination as per Credit System

First Semester:

Course No.	Title of the Paper	Credit	Max. Marks.	Double Valuation (Internal + External)	Internal Assessment
101	Algebra-I	6	100	85	15
102	Real Analysis-I	6	100	85	15
103	Topology-I	6	100	85	15
104	Differential Equations-I	6	100	85	15
105	Discrete Mathematics	6	100	85	15
	Total	30	500	425	75

Second Semester:

Course No.	Title of the Paper	Credit	Max. Marks.	Double Valuation (Internal + External)	Internal Assessment
201	Algebra-II	6	100	85	15
202	Real Analysis-II	6	100	85	15
203	Topology-II	6	100	85	15
204	Complex Analysis-I	6	100	85	15
205	Linear Algebra	6	100	85	15
	Total	30	500	425	75

Third Semester:

Course No.	Title of the Paper	Credit	Max. Marks.	Double Valuation (Internal + External)	Internal Assessment
301	Functional Analysis	6	100	85	15
302	Complex Analysis-II	6	100	85	15
303	Specialization Papers: (a) Number Theory-I (OR) (b) Operations Research-I	6	100	85	15
304	Specialization Papers: (a) Lattice Theory-I (OR) (b) Universal Algebra-I	6	100	85	15
305	Specialization Papers: (a) Commutative Algebra-I (OR) (b) Semigroups-I	6	100	85	15
	Total	30	500	425	75

Fourth Semester:

Course No.	Title of the Paper	Credit	Max. Marks.	Double Valuation (Internal + External)	Internal Assessment
401	Integration Theory	6	100	85	15
402	Partial Differential Equations	6	100	85	15
403	Specialization Papers: (a) Number Theory-II (OR) (b) Operations Research-II	6	100	85	15
404	Specialization Papers: (a) Lattice Theory-II (OR) (b) Universal Algebra-II	6	100	85	15
405	Specialization Papers: (a) Commutative Algebra-II (OR) (b) Semigroups-II	6	100	85	15
	Viva - Voce	6	100	100*	-
		36	600	525	75

* Single Valuation by Viva-Voce committee.

Total Marks: First, Second, Third & Fourth Semesters put together: 500+500+500+600 = 2100

Total Credits: First,Second, Third & Fourth Semesters put together: 30+30+30+36 = 126

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DEPARTMENT OF MATHEMATICS
M.A/M.SC MATHEMATICS
I-SEMESTER

M 101 ALGEBRA – I

UNIT I

Normal subgroups - Quotient groups - Isomorphism theorems – Automorphisms - Conjugacy and G-Sets - Cyclic Decomposition.

Chapters 5 and Section 7.1 of chapter 7 of the prescribed text book.

UNIT II

Alternating group A_n – Simplicity of A_n- Direct Products - finitely generated abelian groups - Invariants of a finite abelian group.

Sections 7.2, 7.3 of Chapter 7 and Sections 8.1, 8.2 and 8.3 of chapter 8 of the prescribed text book.

UNIT III

Sylow theorems - Groups of orders p^2, pq- Ideals, Homomorphisms, Sum and direct sum of ideals.

Sections 8.4, 8.5 of Chapter 8 and Sections 10.1, 10.2 and 10.3 of Chapter 10 of the prescribed text book.

UNIT IV

Maximal and Prime Ideals- Nilpotent and Nil Ideals, Zorn's Lemma.

Sections 10.4, 10.5 and 10.6 of Chapter 10 of the Prescribed text book.

UNIT V

Unique factorization domains, Principal ideal domains, Polynomial rings over UFD.

Chapter 11 of the prescribed text book.

Prescribed Book:

Basic Abstract Algebra: P. B. Bhattacharya, S. K. Jain and S. R. Nagapaul, Second edition, reprinted in India 1997, 2000, 2001

I-SEMESTER

M 102 REAL ANALYSIS-I

UNIT I

Definition and existence of the Riemann Stieltjes integral, Properties of the integral, integration and differentiation – the fundamental theorem of calculus.

6.1 to 6.22 of chapter 6 of the text book.

UNIT II

Integration of vector valued functions – Rectifiable curves- Sequences and series of the functions – Pointwise and uniform convergence – uniform convergence and continuity.

6.23 to 6.27 of chapter 6 and 7.1 to 7.15 of Chapter 7 the of text book.

UNIT III

Uniform convergence and integration – uniform convergence and differentiation. The Stone-Weierstrass Theorem - Power series – Abel's theorem.

Sections 7.16 to 7.33 of Chapter 7 and 8.1, 8.2 of Chapter 8 of the text book.

UNIT IV

Inversion in the order of summation – Taylor's theorem – uniqueness of power series. Functions of several variables – linear transformations – Derivatives in an open subset of IR – Chain rule.

8.3 to 8.5 of Chapter 8 and 9.1 to 9.15 of the text book.

UNIT V

Partial derivatives – The contraction principle – The inverse function theorem – the implicit functions theorem.

9.16 to 9.29 of Chpater 9 of the text book.

TEXT BOOK

Walter Rudin – Principles of Mathematical Analysis (3rd edition), McGraw-Hill, International Book Company, 1976, International Student Edition.

I-SEMESTER

M 103 TOPOLOGY-I

UNIT I

Finite sets – Countable and uncountable sets – infinite sets and the axiom of choice – well ordered sets – the maximum principle.

Sections 6, 7, 9, 10 and 11 of Chapter I

UNIT II

Topological spaces – Basis for a Topology – The order topology – The product topology on X x Y – the subspace topology.

Sections 12 to 16 of Chapter 2

UNIT III

Closed sets and limit points - Continuous functions – the product topology.

Sections 17 to 19 of Chapter 2

UNIT IV

Metric spaces – the metric topology - Connected spaces – connected subspaces of the real line.

Sections 20, 21 of Chapter 2 and Sections 23, 24 of Chapter 3

UNIT V

Compact spaces – compact subspaces of the real line – limit point compactness – Local compactness.

Sections 26 to 29 of Chapter 3.

Extent and content as in the book: Topology by James R. Munkers, Second edition, Pearson education Asia – Low price edition

I-SEMESTER

M 104 DEFFERENTIAL EQUATIONS – I

UNIT I

Linear Differential equations of Higher Order: Preliminaries – Higher order linear differential equations – a modeling problem – Linear independence – equations with constant coefficients – equations with variable coefficients – wronskian.
Sections 2.1 to 2.7 of Chapter 2.

UNIT II

Variation of parameters – some standard methods – method of Laplace transforms - Solutions of Differential equations in Power Series : Preliminaries – Second order linear equations with Ordinary points – Legendre equations with Legendre Polynomials.
Sections 2.8 to 2.10 of Chapter 2 and Sections 3.1 to 3.3 of Chapter 3.

UNIT III

Second order equations with regular singular points – Properties of Bessel functions - Systems of Linear Differential Equations : Preliminaries – Systems of First order equations – Model for arms competitions between two nations – Existence and uniqueness theorem – Fundamental matrix.
Sections 3.4 & 3.5 of Chapter 3 and Sections 4.1 to 4.5 of Chapter 4

UNIT IV

Non homogeneous linear systems – Linear systems with constant coefficients – Linear systems with periodic coefficients - Existence and Uniqueness of solutions: Preliminaries – successive approximations – Picard's theorem – Some examples.
Sections 4.6 to 4.8 of Chapter 4 and Sections 5.1 to 5.5 of Chapter 5.

UNIT V

Continuation and dependence on initial conditions – Existence of solutions in the large – Existence and Uniqueness of solutions of systems – Fixed point method.
Sections 5.6 to 5.9 of Chapter 5.

Text book: S. G. Deo, V. Lakshmikantham and V. Raghavendra: Text book of Ordinary Differential Equations, Second edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1997.

I-SEMESTER

M 105 DISCRETE MATHEMATICS

UNIT I

Graphs, digraphs, network, multigraph, Elementary results, structure based on connectivity, characterizations.

UNIT II

Theorems on trees, tree distances, binary trees - Eulerian graphs, Hamiltonian graphs, Spanning trees.

UNIT III

Fundamental cycles, unrestricted graphs, minimal spanning trees, kruskal algorithm, prims algorithm.

UNIT IV

Definitions of lattices, Modular lattices and distributive lattices.

UNIT V

Basic properties, Boolean polynomials, ideals, minimal forms of Boolean polynomials, Application of Lattices, Switching circuits.

Text Book I: Graph Theory applications By L. R. Foulds, Narosa publishing House, New Delhi

Text Book II: Discrete Mathematical Structures by Kolman and Busby and Sharen Ross, Prentice Hall of India-2000 3rd Edn.

Text Book III: Applied Abstract Algebra by Rudolf Lidl and Gunter Pilz, Published by Springer verlag.

II-SEMESTER
M 201 ALGEBRA – II

UNIT I

Algebraic extension of fields: Irreducible polynomials and Eisenstein's criterion. Adjunction of roots. Algebraic extensions.

Sections 15.1, 15.2 and 15.3 of Chapter 15 of the prescribed text book

UNIT II

Algebraically closed fields, Normal and separable extensions: Splitting fields, Normal extensions, multiple roots.

Section 15.4 of Chapter 15 and Sections 16.1, 16.2, 16.3 of Chapter 16 of the prescribed text book

UNIT III

Finite fields, separable extensions, Galois theory: Automorphism groups and fixed fields,

Sections 16.4, 16.5 of Chapter 16 and Section 17.1 of Chapter 17 of the prescribed text book

UNIT IV

Fundamental theorem of Galois theory, Fundamental theorem of algebra- Applications of Galois theory to classical problems: Roots of unity and cyclotomic polynomials.

Sections 17.2, 17.3 of Chapter 17 and Section 18.1 of Chapter 18 of the prescribed text book

UNIT V

Cyclic extensions, polynomials solvable by radicals, symmetric functions, Ruler and compass constructions

Sections 18.2, 18.3, 18.4 and 18.5 of Chapter 18 of the prescribed text book

Prescribed Book:

Basic Abstract Algebra: P. B. Bhattacharya, S. K. Jain and S. R. Nagpaul, Second edition, Cambridge University Press, printed and bound in India at Replika Press Pvt. Ltd., 2001.

II-SEMESTER

M 202 REAL ANALYSIS-II

UNIT I

Lebesgue measure: Introduction, Outer measure, measurable sets and Lebesgue measure, A non measurable set, measurable functions.

Sections 3.1 to 3.5 of Chapter 3 of the text book

UNIT II

Little woods three principles, The lebesgue Integral: The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure.

Section 3.6 and sections 4.1, 4.2 of Chapter 4 of the textbook

UNIT III

The integral of a nonnegative function, the general Lebesgue integral, convergences in measure.
Differentiation and integration: Differentiation of monotone functions.

Sections 4.3, 4.4, 4.5 of Chapter 4 and section 5.1 of chapter 5 of the textbook

UNIT IV

Functions of bounded variation and differentiation of an integral, Absolute continuity, and convex functions, The classical Banach spaces: The L^p-spaces, The Holder's and Minkoswki's inequality,

Sections 5.2 to 5.5 of Chapter 5 and sections 6.1, 6.2 of chapter 6 of the textbook

UNIT V

Convergences and completeness, approximations in L^p spaces, Linear functionals on L^p spaces.

Sections 6.3, 6.4 and 6.5 of chapter 6.

Textbook: Real analysis by H. L. Royden, Macmillan publishing co.inc. 3rd edition, New York, 1988.

II-SEMESTER

M 203 TOPOLOGY II

UNIT I

The countability axioms-the separation axioms, Normal Spaces, the Urysohn lemma, The Urysohn metrization theorem.

Sections 30 to 34 of Chapter 4.

UNIT II

The Tietze extension theorem. - The Tychnoff's theorem- the stone-cech compactification

Sections 35 of Chapter 4 and 37 and 38 of Chapter 5.

UNIT III

Local finiteness-The Nagata-Smirnov Metrization theorem - Complete metric spaces-Compactness in metric spaces

Sections 39, 40 of chapter 6 and sections 43, 45 of chapter 7

UNIT IV

Point wise and compact convergence- Ascoli's theorem.

Sections 46, 47 of chapter 7

UNIT V

Baire space, Introduction to dimension theory.

Section 48, 50 of Chapter 8.

Content and extent as in the book

Topology by James R. Munkres, Second edition, Pearson education, Asia-low price edition

II-SEMESTER

M 204 COMPLEX ANALYSIS - I

UNIT-I

Elementary properties and examples of analytic functions: Power series- Analytic functions- Analytic functions as mappings.

Sections 1,2,3 of Chapter – III

UNIT-II

Mobius transformations - Complex Integration: Riemann- Stieltjes integrals- Power series representation of analytic functions.

Section 3 of Chapter – III and Sections 1,2 of Chapter –IV

UNIT-III

Zeros of an analytic functions- The index of a closed curve.Cauchy's theorem and integral formula.

Sections 3,4,5 of Chapter – IV

UNIT- IV

The homotophic version of cauchy's theorem and simple connectivity- Counting zeros; the open mapping theorem.

Sections 6,7 of Chapter – IV

UNIT-V

Singularities: Classifications of singularities- Residues- The argument principle.

Sections 1,2,3 of Chapter – V

Prescribed text book:

Functions of one complex variables by J.B.Conway : Second edition, Springer International student Edition, Narosa Publishing House, New Delhi.

II-SEMESTER

M 205 LINEAR ALGEBRA

UNIT I

Elementary Canonical Forms: Introduction-Charecteristic Values-Annihilating Polynomials-Invariant Subspaces-Simultaneous Triangulation.

Sections 6.1, 6.2, 6.3, 6.4, 6.5 of chapter 6 in Prescribed Text book

UNIT II

Simultaneous Diagonalization, Direct-sum Decompositions-Invariant Direct Sums-The Primary Decomposition Theorem

Sections 6.5, 6.6, 6.7 and 6.8 of Chapter 6 in Prescribed Text book

UNIT III

Cyclic Subspaces and Annihilators-Cyclic Decompositions and the Rational Form, The Jordan Form-Computation of Invariant Factors.

Sections 7.1, 7.2, 7.3 and 7.4 of Chapter 7 in Prescribed Text book

UNIT IV

Semi-Simple Operators- Bilinear Forms: Bilinear Forms.

Sections 7.5 of Chapter 7 and section 10.1 of chapter 10 in Prescribed Text book

UNIT V

Symmetric Bilinear Forms-Skew Symmetric Bilinear Forms-Group Preserving Bilinear Forms.

Sections 10.2, 10.3 and 10.4 of Chapter 10 in Prescribed Text book

Prescribed Text Book: Linear Algebra second edition By Kenneth Hoffman and Ray Kunze, Prentice-Hall of India Private Limited, New Delhi-110001, 2002.

DR. B.R. AMBEDKAR UNIVERSITY, SRIKAKULAM
DEPARTMENT OF MATHEMATICS
M.SC MATHEMATICS
III-SEMESTER

M 301 FUNCTIONAL ANALYSIS

UNIT I

Banach spaces: The definition and some examples, continuous linear transformation, The Hahn-Banach theorem, the natural imbedding of N in N**.
Sections 46 to 49 of Chapter 9 of the text book.

UNIT II

The open mapping theorem, The conjugate of an operator, Hilbert spaces: The definition and some simple properties, orthogonal complements.
Sections 50, 51 of Chapter 9 & Sections 52, 53 of Chapter 10 of the text book.

UNIT III

Orthonormal sets, The conjugate space H^*, the adjoint of an operator, Self-adjoint operators.
Sections 54 to 57 of Chapter 10 of the text book.

UNIT IV

Normal and Unitary operators, Projections, Finite-dimensional spectral theory: Matrices.
Sections 58, 59 of Chapter 10 & Section 60 of Chapter 11 of the text book.

UNIT V

Determinants and the spectrum of an operator, the spectral theorem. A survey of the situation.
Sections 61 to 63 of Chapter 11 of the text book.

Text Book: Introduction to Topology and Modern Analysis by G. F. Simmons, McGraw Hill Book Company. Inc-International student edition.

References:

1. Functional Analysis by B. V. Limaye, Willey Eastern Limited, Bombay 1981.
2. First Course in Functional Analysis, C. Goffman and George Pedrick, Prentice Hall of India Private Limited, New Delhi-110001.

III-SEMESTER

M 302 COMPLEX ANALYSIS II

UNIT I

The maximum modulus theorem: The maximum principle-Schwarz's lemma- Convex functions and Hadamard's three circles theorem- Phragmen- Lindelof theorem.

Sections 1,2,3,4 of Chapter-VI of the prescribed text book

UNIT II

Compactness and convergence in the Spaces of Analytic Functions: The space of continuous functions C (G, Ω) - Spaces of Analytic functions- Spaces of meromorhic functions- The Riemann Mapping Theorem.

Sections 1, 2, 3, 4 of Chapter-VII of the prescribed text book

UNIT III

Weierstrass Factorization theorem- Factorization of sine functions, Runge's Theorem: Runge's Theorem-Simple connectedness.

Sections 5, 6 of Chapter-VII & Sections 1, 2 of Chapter- VIII of the prescribed text book

UNIT IV

Mittag-Leffler's Theorem, Analytic Continuation and Riemann Surfaces, Schwarz Reflection Principle- Analytic Continuation Along A Path- Mondromy Theorem.

Section 3 of Chapter- VIII & Sections 1, 2, 3 of Chapter-IX of the prescribed text book

UNIT V

Harmonic Functions: Basic properties of Harmonic functions- Harmonic functions on a disk. Jenson's formula, The genus and the order of an entire function Hadamard's factorization theorem.

Sections 1, 2, of Chapter- X and Sections 1, 2, 3 of Chapter- XI of the prescribed text book

Prescribed text book: Functions of one complex variables by J. B. Conway: Second edition, Springer International Student Edition. Narosa Publishing House, NEW DELHI.

III-SEMESTER

M 303(a)-NUMBER THEORY- I

UNIT-I

Introduction- The Mobius function function μ (n) – The Euler totient function φ(n)- A relation connecting φ and μ - A product formula for φ(n)- The Dirichlet product of arithmetical functions- Dirichlet inverses and the Mobius inversion formula- The Mangoldt function Λ(n).

Sections 2.1 to 2.9 of Chapter-2 of the prescribed text book.

UNIT-II

Multiplicative functions- multiplicative functions and Dirichlet multiplication- The inverse of a completely multiplicative function-Liouville's function $\lambda(n)$ - The divisor functions $\sigma_\alpha(n)$. Generalized convolutions, Introduction- The big oh notation. Asymptotic equality of functions- Euler's summation formula- Some elementary asymptotic formulas.

Sections 2.10 to 2.14 of Chapter 2 & Sections 3.1 to 3.4 of Chapter -3 of the prescribed text book.

UNIT-III

The average order of d(n)- The average order of the divisor functions $\sigma_\alpha(n)$ - The average order of φ(n)- An application to the distribution of lattice points visible from the origin- The average order of μ (n) and Λ(n)-The partial sums of a Dirichlet product- Applications to μ (n) and Λ(n)- Another identity for the partial sums of a Dirichlet product.

Sections 3.5 to 3.12 of Chapter 3 of the prescribed text book.

UNIT-IV

Introduction- Chebyshev's functions $\psi(x)$ and $\vartheta(x)$ - Relations connecting $\vartheta(x)$ and $\pi(x)$ - Some equivalent forms of the prime number theorem-Inequalities for $\pi(n)$ and p_n - Shapiro's Tauberian theorem- Applications of Shapiro's theorem- An asymptotic formula for the partial sums $\sum_{p\le x}(1/p)$ - The partial sums of the Mobius function.

Sections 4.1 to 4.9 of Chapter-4 of the prescribed text book.

UNIT-V

Definition and basic properties of congruences- Resudue classes and complete residue systems- Linear congruences- Reduced residue systems and the Euler- Fermat theorem- Polynomial congruences modulo p. Lagrange's theorem- Applications of Lagrage's theorem- Simultaneous linear congruences. The Chinese remainder theorem- Applications of the Chinese remainder theorem- Polynomial congruences with prime power moduli.

Sections 5.1 to 5.9 of Chapter -5 of the prescribed text book.

TEXT BOOK: Introduction to Analytic Number Theory- By T.M.APOSTOL- Springer Verlag-New York, Heidalberg-Berlin-1976.

III-SEMESTER

M 303(b) OPERATIONS RESEARCH – I

UNIT I :

Linear Programming: The Simplex Method – Overall Idea of the Simplex Method – Development of the Simples Method – Primal Simplex method – Dual Simplex Method – Special cases in Simplex Method Applications.

UNIT II :

Sensitivity Analysis- Revised Simplex Method and Duality: Mathematical Foundations – Revised (Primal) Simplex Method – Definition of the Dual Problem.

UNIT III:

Solution to the Dual Problem – Economic Interpretation of the Dual Problem-Transportation Model and Net Works: Definitions and Applications of the Transportation – Solution of the Transportation Problem – The Assignment Model – The Transhipment Model.

UNIT IV :

Network Definitions – Minimal Spanning Tree problem – Shortest – Route Problem-Network Models and Project Scheduling: Maximal Flow Problem – Minimum Cost Capacitated Flow Problem.

UNIT V:

Arrow (Network) Diagram Representations – Critical Path Calculations – Construction of the Time Chart and Resource Leveling.

Text Book: Operations Research, An Introduction: Hamdy A Taha, Maxwell Macmillan International Edition, New York, 1992.

III SEMESTER
M 304(a) LATTICE THEORY-I

UNIT-I:-

Partially Ordered sets- Diagrams- Special subsets of a poset –length- lower and upper bounds- the minimum and maximum condition- the Jordan Dedekind chain conditions – Dimention functions.

Chapter I of the prescribed text book.

UNIT-II:-

Algebras-lattices- the lattice theoretic duality principle- semilattices- lattices as posets- diagrams of lattices- sub lattices, ideals- Bound elements of Lattices-atoms and dual atoms-complements, relative complements, semi complements-irreducible and prime elements of a lattice- the homomorphism of a lattice-axioms systems of lattices.

Chapter II of the prescribed text book.

UNIT-III:-

Complete lattices- complete sublattices of a complete lattice- conditionally complete lattices- Sigma lattices- Compact elements, compactly generated lattices- subalgebra lattice of an algebra-closure operations- Galois connections, Dedekind cuts- partially ordered sets as topological spaces.

Chapter III of the prescribed text book.

UNIT-IV:-

Distributive lattices-infinitely distributive and completely distributive lattices-modular lattices- Characterization of modular and distributive lattices by their sublattices- distributive sublattices of modular lattices- the isomorphism theorem of modular lattices, covering conditions-meet representations in modular and distributive lattices.

Chapter IV of the prescribed text book.

UNIT-V:-

Some special subclasses of the class of modular lattices-preliminary theorems – modular lattices of locally finite length- the valuation of a lattice, metric and quasi metric lattices- complemented modular lattices.

Chapter V of the prescribed text book.

Prescribed Text Book: Introduction to Lattice Theorey, by Gabor Szasz, Academic Press, New York.
Book for reference: General Lattice Theory by G. Gratzer, Academic Press, New York.

III-SEMESTER

M 304(b) UNIVERSAL ALGEBRA-I

UNIT-I:-

Definitions of Lattices – Isomorphisms of Lattices and Sub lattices- Distributive and Modular Lattices- Complete lattices- Equivalence relations- Algebraic lattices.

Sections 1 to 4 of Chapter 1 of the prescribed text book.

UNIT-II:-

Closure operators, Definition and examples of algebras- Isomorphic algebras and sub algebras – Algebraic lattices and sub universes.

Section 5 of Chapter 1 & Sections 1 to 3 of Chapter 2 of the prescribed text book.

UNIT-III:-

The irredundant Basis theorem- Congruences and Quotient algebras. Homomorphisms – The homomorphism and isomorphism theorems, Direct products- Factor congruences – Directly indecomposable algebras.

Sections 4 to 7 of Chapter 2 of the prescribed text book.

UNIT-IV:-

Sub direct products- Subdirectly irreducible algebras- Simple algebras- Class operators- Varieties.Terms- Term algebras- Free algebras.

Sections 8 to 10 of Chapter 2 of the prescribed text book.

UNIT-V:-

Identities and Free algebras- Birkhoff's theorem- Malcev conditions- The Centre of an algebra.

Sections 11 to 13 of Chapter 2 of the prescribed text book.

Prescribed Book: A course in Universal algebra- Stanley Burris, H.P. Sankappanavar, Springer-Verlag, New York- Heidelberg- Berlin.

III-SEMESTER

M 305(a) COMMUTATIVE ALGEBRA- I

UNIT-I

Rings and ring homomorphism, ideals, quotient rings, zero divisors, Nilpotent elements, units, prime ideals and Maximal ideals.

Articles 1.1 to 1.6 of Chapter 1 of the prescribed text book.

UNIT-II

Nil radical and Jacobson radical, operations on ideals, Extensions and contractions- Modules and module homomorphisms, Sub modules and quotient modules, operations on submodules, Direct sum and product, finitely generated modules.

Articles 1.7 to 1.18 of Chapter 1 & Sections 2.1 to 2.8 of Chapter 2 of the prescribed text book.

UNIT-III

Exact sequences, Tensor product of modules, Restriction and extension of scalars, Exactness properties of the tensor product, algebras, tensor product of algebras.

Sections 2.9 to 2.20 of Chapter 2 of the prescribed text book.

UNIT-IV

Local Properties- Extended and contracted ideals in rings of fractions.

Chapter 3 of the prescribed text book.

UNIT-V

Primary decompositions.

Chapter 4 of the prescribed text book.

Prescribed text book: Introduction to commutative algebra, By M.F. ATIYAH and I.G. MACDONALD, Addison-Wesley publishing Company, London.

III-SEMESTER

M 305(b) SEMI GROUPS- I

UNIT-I

Basic definition, monogenic semigroups, ordered sets, semilatttices and lattices, binary relations, equivalences and congruences.

UNIT-II

Free semigroups, Ideals and Rees' congruences, Lattices of equivalences and congruences.

UNIT-III

Green's equivalences, the structure of D-classes, regular semigroups- Simple and 0-simple semigroups.

UNIT-IV

Principal factors, Rees' theorem, Primitive idempotents.Congruences on completely 0-simple semi groups.

UNIT-V

The lattice of congruences on a completely 0-simple semigroup, Finite congruence free semigroups.

Contents of the syllabus-Chapters 1,2 and 3 of the text book.

Text Book: An introduction to semi group theory by J.M. Howie, 1976, Academic press, New York.

IV-SEMESTER

M 401 INTEGRATION THEORY

UNIT-I

Measure and Integration : Measure spaces- Measureble functions- Integration – General convergence theorems.

Section 1 to 4 of Chapter 11 of the Text Book.

UNIT-II

Signed measures- The Radon-Nikodyn theorem.The Lp –spaces.

Section 5 to 7 of chapter 11 of the Text Book.

UNIT-III

Outer measure and measurability- The extension theorem – The Lebesgue- Stieltjes integral- Product measures.

Sections 1 to 4 of Chapter 12 of the Text Book.

UNIT-IV

Inner measure – Extensions by sets of measure zero- Caratheodory outer measure.

Section 6 to 8 of Chapter 12 of the Text Book.

UNIT-V

The Daniell Integral : Introduction – The Extension theorem- Uniqueness- Measurability and measure.

Sections 1 to 4 of Chapter 16 of the Text Book.

Text Book: H. L. Royden- Real Analysis, Macmillan Publishing Company, New York, Third Edition, 1988.

IV-SEMESTER

M 402 PARTIAL DIFFERENTIAL EQUATIONS

Unit I:

Introduction to Partial differential equations – Definitions; Examples – Linear equations, Nonlinear equations, Linear systems, Nonlinear systems; Strategies for studying PDE – well posed problems, classical solutions, weak solutions and regularity, Typical difficulties (*Only short answer questions to be asked from this portion*).

Unit II:

Transport equation – Initial value problem, Nonhomogeneous problem Laplace 's equation – Physical interpretation; Fundamental solution - Derivation of fundamental solution, Poisson's equation; Mean value formulas; Properties of harmonic functions-strong maximum principle, uniqueness, regularity, Local estimates for harmonic functions, Liouville's theorem, Harnack's inequality, Green's function – Derivation of green's function, Green's function for a half space, Green's function for a ball; Energy methods – Uniqueness, Dirichlet's principle- Heat Equation – physical interpretation; Fundamental solution – Derivation of the fundamental solution.

Unit III:

Initial value problem, Nonhomogeneous problem; Mean value formula; Properties of solutions – strong maximum principle, uniqueness, regularity, Local estimates for the solutions of the heat equation; Energy methods – uniqueness, Backward uniqueness-Wave equation – Physical interpretation; Solution by spherical means – Solution for $n = 1$.

Unit IV:

d'Alembert's formula, Spherical means, Solution for $n = 3,2$ Kirchhoff's and Poisson's formulas, Solution for odd n, Solution for even n; Nonhomogeneous problem; Energy methods – uniqueness, Domain of dependence.

Unit V:

Nonlinear first order Partial differential equation – Complete integrals, new solutions from envelops; Characteristics – Derivation of characteristic ODE; Examples for liner, quasilinear, fully nonlinear equations; Boundary conditions – Straightening the boundary, Compatibility conditions on boundary data, noncharacteristic boundary data; Local solution ; Applications to liner, quasilinear, fully nonlinear equations.

Text book: L.C. Evans, Partial differential equations, Graduate studies in Mathematics, Volume 19, AMS, 2002.

Reference books:

1 Fritz John, Partial Differential Equations, Narosa Publishing House, New Delhi, 1979
2 Phoolan Prasad and Renuka Ravindran, Partial Differential Equations, New Age International Publishers, New Delhi, 1996.
3 Ian Sneddon, Elements of Partial Differential Equations, McGraw-Hill International editions, Singapore.

IV-SEMESTER

M 403(a) NUMBER THEORY- II

UNIT-I

Characters of finite abelian groups- The character group- The orthogonality relations- for characters- Dirichlet characters- Sums involving Dirichlet characters-The nonvanishing of $L(1, \chi)$ for real nonprincipal χ. Introduction- Dirichlet's theorem for primes of the form 4n-1 and 4n+1- The plan of the proof of Dirichlet's theorem- Proof of Lemma 7.4.

Sections 6.5 to 6.10 of Chapter 6 & Sections 7.1 to 7.4 of Chapters 7 of the prescribed text book.

UNIT-II

Proof of Lemma 7.5- Proof of Lemma 7.6- Proof of Lemma 7.7- Proof of Lemma 7.8- Distribution of primes in arithmetic progressions. Functions periodic modulo k- Existence of finite Fourier series for periodic arithmetical functions- Ramanujan's sum and generalizations- Multiplicative properties of the sums $s_k(n)$- Gauss sums associated with Dirichlet characters-

Sections 7.5 to 7.9 of Chapter 7 & Sections 8.1 to 8.5 of Chapter 8 of the prescribed text book.

UNIT-III

Dirichlet characters with nonvanishing Gauss sums- Induced moduli and primitive characters- Further properties of induced moduli- The conductor of a character- Primitive characters and separable Gauss sums- The finite Fourier series of the Dirichlet characters- Polya's inequlity for the partial sums of primitive characters.
Quadratic residues- Legendre's symbol and its properties- Evaluation of (-1/p) and (2/p)-

Sections 8.6 to 8.12 of Chapter 8 & Sections 9.1 to 9.3 of Chapter 9 of the prescribed text book.

UNIT-IV

Gauss Lemma-The quadratic reciprocity law-Applications of the reciprocity law- The Jacobi symbol-Applications to Diophantine equations- Gauss sums and the quadratic reciprocity law.
The exponent of a number mod m. Primitive roots- Primitive roots and reduced residue systems-The nonexistence of primitive roots mod 2^{α} for $\alpha \geq 3$- The existence of primitive roots and p for odd primes p.

Sections 9.4 to 9.9 of Chapter 9 & Sections 10.1 to 10.4 of Chapter 10 of the prescribed text book.

UNIT-V

Primitive roots and quadratic residues- The existence of primitive roots mod p^{α} - The existence of primitive roots mod $2p^{\alpha}$ - The non existence of primitive roots in the remaining cases- The number of primitive roots mod m. The index calculus- Primitive roots and Dirichlet characters-Real-valued Dirichlet characters mod p^{α} -Primitive Dirichlet characters mod p^{α} .

Sections 10.5 to 10.13 of Chapter- 10 of the prescribed text book.

TEXT BOOK: Introduction to Analytic Number Theory- By T.M.APOSTOL-
Springer Verlag-New York, Heidalberg-Berlin-1976.

IV-SEMESTER

M 403(b) OPERATIONS RESEARCH - II

UNIT – I:

Integer Programming: Illustrative Applications of Integer Programming – Solution Method of Integer Programming – Branch and bound Algorithm.

UNIT – II

Cutting Plane Algorithms – Zero-one Integer Problem- Decision theory and Games: Decisions Under Risk – Decision Tree.

UNIT – III

Decisions Under Uncertainty – Game Theory.

UNIT-IV

Classical Optimization Theory: Unconstrained Extremal Problems – Constrained Extremal Problems.

UNIT –V

Non linear Programming: Unconstrained Non linear Algorithms – Constrained Non linear Algorithms.

Text Book: Operations Research, An Introduction: Hamdy A Taha, Maxwell Macmillan International Edition, New York, 1992.

IV-SEMESTER

M 404(a) LATTICE THEORY-II

UNIT- I

Boolean algebras, De Morgan formulae- Complete Boolean algebras- Boolean algebras and Boolean rings- The algebra of relations- The lattice of propositions- Valuations of Boolean algebras.

Chapters VI of the prescribed text book.

UNIT-II

Birkhoff lattices- Semimodular lattices- Equivalence lattices- Linear dependence- Complemented semimodular lattices.

Chapter VII of the prescribed text book.

UNIT-III

Ideals and dual ideals- Ideal chains- Ideal lattices- Distributive lattices and rings of sets.

Chapter VIII of the prescribed text book.

UNIT-IV

Congruence relation of an algebra- Permutable equivalence relations- The Schreier refinement theorem in arbitrary algebras.

Sections 56to 58 of Chapter IX of the prescribed text book.

UNIT-V

Congruence relations of lattices- Minimal congruence relations of some subsets of a distributive lattice- The connection between ideals and congruence relations of a lattice.

Sections 59 to 61 of chapters IX of the prescribed text book.

Prescribed text book:
Introduction to Lattice Theory by Gabor Szasz, Academic Press, New York.

Books for reference:
General Lattice Theory by G. Gratzer, Academic Press, New York.

IV-SEMESTER

M 404(b) UNIVERSAL ALGEBRA-II

UNIT-I :

Boolean Algrbras- Boolean rings – Filters and ideals.

UNIT-II :

Stone identity - Boolean Powers- Ultra products and congruences- Distributive varieties.

UNIT-III:

Primal algebras- Boolean Products.- Discriminator varieties – Quasi primal algebras –

UNIT-IV:

Functionally complete algebras – skew-free algebras- Semisimple varieties – Directly representable varieties.

UNIT-V:

First order Languages – First order structures and satisfaction – Reduced products and ultra products.

Content and extent as in the Book:-
A course in universal algebra- Stanely Burris and H.P. Sankappanarayan, Springer-Verlag, Berlin.

IV-SEMESTER

M 405(a) COMMUTATIVE ALGEBRA-II

UNIT-I:

Integral dependence, the going-up theorem-Integrally closed integral domains.

Sections 5.0 to 5.15 of Chapter V of the prescribed text book.

UNIT-II:

The going-down theorem, valuation rings.

Sections 5.16 to 5.24 of Chapter V of the prescribed text book.

UNIT-III:

Chain Conditions.

Chapter VI of the prescribed text book.

UNIT-IV:

Noetherian rings- Primary decomposition of Noetherian rings, Artin rings.

Chapters VII & VIII of the prescribed text book.

UNIT-V:

Discrete valuation rings, Dedekind domains, Fractional ideals.

Chapter IX of the prescribed text book.

Prescribed Text Book : Introduction to commutative algebra by M.F.Atiya and I.G. Macdonald, Addison-Welsey Publishing Company, London.

IV-SEMESTER

M 405 (b) SEMI GROUPS-II

UNIT-I

Union of Groups, Semi lattices of groups, bands, free bands, varieties of bands.

UNIT-II

Introduction to inverse semi groups, preliminaries, the natural partial order on an inverse semi group.

UNIT-III

Fundamental inverse semi groups, anti-uniform semilattices- Bi-simple inverse semi groups, simple inverse semi-groups.

UNIT-IV

Representation of inverse semigroups- Orthodox semigroups, basic properties, the analogue of the Munn semi-group.

UNIT-V

Uniform and anti-uniform bands, the structure of orthodox semi groups.

Contents of the syllabus: Chapters 4,5 and 6 of the text book.

Text Book: An introduction to semigroup theory by J.M.Howie, 1976, Academic press, New York.

MODEL QUESTION PAPER

M.A /M.Sc/M.Com/MCA/MLISc/M.Ed/B.Ed(MR)/DEGREE EXAMINATIONS

COURSE IN: _____

SEMESTER_____

PAPER No._____ & TITLE: _____

TIME: 3 Hrs **Max Marks: 85**

SECTION – A

Question No.1 is Compulsory

Answer ALL questions

Each answer shall not exceed one page or 200 words

1. **(5 x 5 = 25)**

A.

B.

C.

D.

E.

SECTION – B

Answer ALL questions

Each answer shall not exceed five page or 1000 words

(5 x 12 = 60)

UNIT-I

2.

Or

3.

UNIT-II

4.

Or

5.

UNIT-III

6.

Or

7.

UNIT-IV

8.

Or

9.

UNIT-V

10.

Or

11.