KANNUR UNIVERSITY

(Abstract)

B.Sc (Honours) in Mathematics Degree Programme –**Revised Regulations, Scheme Syllabi, & Pattern of Question Paper** -Implemented with effect from 2016 Admission – Orders issued.

ACADEMIC C SECTION

U.O.No.Acad/C2/6190/2016

Dated, Civil Station.P.O ,30. 08.2016

Read: 1. Lr.No.3961/B1/H.Edn dated 9th July 2013 from the Additional Chief Secretary to Govt .Higher Education & Social Justice Department ,Govt.of Kerala ,Thiruvananthapuram.

2. Meetings of the Board of Studies in Mathematics (UG) held on 20.08.2013 & 29.08.2013.

3. U.O No Acad/C2/9229/2013 dated 06.11.2013

4. Notification No Acad/C3/8732/2013 dated 08.04.2016

5. Meeting of the Board of Studies in B.Sc (Honours) in Mathematics held on 02.05.2016

ORDER

1. The Additional Chief Secretary to Govt .Higher Education & Social Justice Department ,Govt. of Kerala, Thiruvananthapuram vide paper read (1) above has forwarded the draft Scheme & Syllabus for B.Sc (Honours) in Mathematics Degree Programme started in Govt. Brennen College for implementation w.e.f 2013 admission.

2. As per the paper read (2) above, the Board of Studies in Mathematics (UG) finalized the Regulations, Scheme , Syllabi & Model Question Papers in B.Sc (Honours) in Mathematics Degree Programme and the same was implemented in the university vide paper read (3) above , with effect from 2013 admission.

3. A new Board of Studies, i.e Board of Studies in B.Sc (Honours) in Mathematics was constituted in the university vide paper read (4) above.

4. The first meeting of the Board of Studies in B.Sc (Honours) in Mathematics, held vide paper read (5) above, recommended to revise the regulation, Scheme & Syllabus of the course with effect from 2016 admission and finalized the regulations, scheme & syllabus of the course for implementation w.e.f 2016 admission.

5. The Chairman, BOS in B.sc (Honours) in Mathematics forwarded the revised regulation, scheme & syllabus and pattern of question paper of B.Sc (Honours) in Mathematics to be implemented with effect from 2016 admission.

6. The Vice-Chancellor after examining the matter in detail and in exercise of the powers of the Academic Council conferred under Section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with has accorded sanction to implement the revised **Regulations ,Scheme, Syllabi & Pattern of Question Paper in** B.Sc (Honours) in Mathematics Degree Programme with effect from 2016 Admission subject to report to the Academic Council.

7. Orders are therefore issued accordingly.

P.T.O

8. The implemented Regulations, Scheme ,Syllabi & Pattern of Question Paper are appended.

Sd/-
JOINT REGISTRAR (ACADEMIC)
FOR REGISTRAR

To

1. The Principal, Govt.Brennen College,Thalassery

Copy to

1. The Controller of Examinations (Through PA)
2. The Chairman, BOS in B.Sc (Honours) in Mathematics (UG)
3. PS to VC/PA to PVC/ CE/ Registrar.
4. JR/AR-I (Academic)
5. SF/DF/FC.

KANNUR UNIVERSITY
CIVIL STATION P.O.
KANNUR
Pin-670 002
THAVAKKARA

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SECTION OFFICER

For more details log on to www.kannur university.ac.in

REGULATIONS, SCHEME & SYLLABUS

for

B.Sc. (HONOURS) IN MATHEMATICS

(A Six Semester Degree Programme Spread over 3 years)

1. Introduction:-

A good background in Mathematical Sciences is essential to study various disciplines ranging from economics and business administration to computer applications. The programme is designed for students falling in the following categories:

1. Students who aspire for higher studies in Mathematics/Statistics
2. Students who are aiming at M.Sc.(Economics)
3. Students who opt for MCA or MBA

This is a three year degree programme (six semesters of equal duration) in which more topics in Mathematical Sciences are covered than in any conventional B.Sc. Mathematics programme. The topics are logically arranged so that for any course, the prerequisite is covered in the earlier semesters. The treatment for all courses is chosen from standard text books which are used in many reputed Universities in India and abroad. *"For the programme to be effective it is mandatory that questions for internal and external examinations must be from the text books mentioned in the syllabus"*

2. OBJECTIVES OF THE PROGRAMME

B.Sc. (Honours) in Mathematics programme envisages the following from successful candidates who pursued it: He/She should

1. Be able to imbibe and develop mathematical ideas, both abstract and concrete and independently able to apply/invent methods to solve problems in certain real life situations.
2. Be able to pursue higher studies in Mathematical Sciences or allied disciplines from some reputed institutions in India and abroad especially in institutions like IITs, IISER, NITs, ISI IISc etc.,
3. Develop a positive attitude towards creative research in Mathematical Sciences or allied disciplines.

3. **NOMENCLATURE, FACULTY AND ELIGIBILITY FOR ADMISSION**

The name of this programme shall be "**Bachelor of Science (Honours) in Mathematics**"

This undergraduate programme comes under the **Faculty of Science**.

Eligibility for admission: Those who have passed Plus Two or equivalent examinations in science with Mathematics as one of the subjects and secured an aggregate of 70% of marks will be eligible for admission. For those belonging to SC category, an aggregate of 60% marks and for ST, an aggregate of 55% is required.

4. DURATION OF THE PROGRAMME

The duration of the programme shall be three years spread over six semesters of 90 working days each with 5 hours per day and 5 days a week. Maximum duration for successful completion of the programme in the case of failed or discontinued candidates is 6 years. On completion of six years the registration given to the candidate for the programme shall be cancelled and the candidate may re-register for the programme again in order to complete the programme. Such candidates should follow the then existing syllabus.

5. REQUIREMENT OF ATTENDANCE

A minimum of 75% of attendance is required for a candidate to appear for the end-semester examination in each course both in theory and practical. However, if there are genuine reasons, a student shall be permitted to condone the shortage of attendance as per the rules and regulations followed by Kannur University from time to time.

6. EXAMINATION- INTERNAL AND EXTERNAL

There shall be University examination at the end of each semester, written for all the courses except for the elective course BHM 505 B. Programming using Scilab for which there will be external practical examination. Also two external comprehensive viva-voce examinations at the end of 3^{rd} and 6^{th} semesters carrying 50 marks each shall be conducted. In addition to that Individual Project work for 50 marks (Internal 10 marks + End Semester evaluation 40 marks) at the end of 6^{th} semester shall also be conducted. For all the courses, the evaluation consists of two parts: End semester examination (ESE) for 60 marks conducted by the University and internal assessment (IA) for 15 marks conducted by the institution concerned.

The end semester examination will be a written/practical examination of 3 hrs duration.

The pattern of question papers, generally, for all courses in Mathematical sciences (except for the course BHM 505 B. Programming using Scilab) will be

No: of Questions	No: of Questions to be answered	Marks for each question	Total
5	4	1	4
9	6	2	12
12	8	4	32
4	2	6	12

TOTAL : 60 marks

The structure for internal evaluation is as follows:

Test Paper : 8 marks (from a minimum of two test papers)
Viva/Seminar/Assignment: 4 marks
Attendance : 3 marks
TOTAL : 15 marks

In the case of attendance, the following table may be used to award marks for the same.

Attendance in percentage	Marks
Greater than or equal to 90	3
>=80 and <90	2
>=75 and <80	1

External practical examination for the course BHM 505 B. Programming in Scilab falling in the fifth semester of three hour duration shall be conducted for 60 marks. Internal evaluation for 15 marks can be done as per the following:

Written Test Paper/Lab Experimental test : 8 marks (from a minimum of two tests)
Viva/Seminar/Assignment: 4 marks
Attendance : 3 marks
TOTAL : 15 marks

For the practical external examination, two questions on computer programmes from a prescribed set of practical programmes given in the syllabus of this course shall be asked and the duration of practical examination shall be 3 hours. Each student should keep a record book of the prescribed practical works done and the same may be valued by external examiner(s) at the time of external practical examination.

For the external practical examination in the case of BHM 505 B. Programming using Scilab, the marks are distributed as follows:

Practical Record – Maximum 10 marks Writing source code of the programme in the answer sheet for the two given questions– Maximum 20 marks (10 marks each) Practical work done in the computer – Maximum 20 marks (10 marks each) Correct output – Maximum 10 marks (5 marks each)
Total–60 marks

Attending the external practical examination is **mandatory** and no student shall be declared to have passed in these two courses without appearing for the practical examinations concerned.

Regarding the individual project work, the following directions shall be followed. Each student has to prepare a project report on any mathematical topic of their interest under the guidance of a faculty member of the Mathematics Department of the concerned institute where he/she studies. The topic selected should be the one at par or above the undergraduate level and the content should at large deal with concepts not discussed in the syllabus of any of the courses he /she is being offered under this programme. The report should be neatly typewritten or neatly handwritten and the content should be spread into at least 30 pages in the case of typewritten projects and at least 45 pages in the case of handwritten projects. The project report should adhere to the standard norms in which pages for certificate from the guiding supervisor, declaration by the student, acknowledgment and table of contents are to be essentially included. Out of the total 50 marks earmarked for the individual project work, the internal evaluation will be for 10 marks and the remaining 40 marks will be on the basis of a short presentation by the student before a Board of external examiners and a simultaneous viva-voce conducted by them. Though the students have to submit the project report to the University at the end of 6^{th} semester, they may start doing the work early at any point of the programme. 10 marks for internal evaluation of the individual project work are to be distributed as follows:

A maximum of 6 marks for short presentations before the guiding supervisor (at least 5 times during the programme) on the topic of the project work and discussions thereof and a maximum of 4 marks for the project report prepared depending on the quality of its content, over all layout and methodology adopted.

40 marks earmarked for the external evaluation of the individual project are to be distributed as follows:

A maximum of 20 marks for the short presentation of the project work, a maximum of 15marks for the performance in the associated viva-voce examination and a maximum 5 marks for the project report submitted.

With regard to the comprehensive viva-voce, Board of Examiners appointed by the University shall decide on the split up of the total 50 marks.

7. PASS MINIMUM FOR EACH COURSE

A candidate securing E grade with 40% of aggregate marks and 40% separately for ESA for each course shall be declared to have passed in that course. A student who fails to secure minimum E grade for a pass in a course is permitted to write the examination for reappearance along with the subsequent batch. Marks obtained for IA in the first appearance shall be retained (irrespective of pass or fail). Appearance for the internal assessment and end semester examination for each course is compulsory and no grade will be awarded unless a candidate appears for both ESA and IA.

8. PASS CONDITION FOR THE WHOLE PROGRAMME AND CLASSIFICATION

A minimum CGPA of 2.4 is required to declare a student to have passed in the programme and the remaining classifications like First class with distinction, First class, Second class etc should be made as per Table No. 2 given in Annexure III.

9. POSITION CERTIFICATES: Position certificates shall be issued to I, II and III position holders based on the overall grade points i.e., CGPA acquired by the students.

10. REAPPEARANCE /IMPROVEMENT EXAMINATION

There shall be examination for reappearance/improvement of grades which shall be conducted in the following way. For those courses in odd semesters, the same shall be conducted in the odd semester of the successive batches and for even semesters, such exams shall take place in the even semester of the successive batches. Those failing in any one course need reappear only in that course. Those who appear for these examinations shall pay the examination fee as prescribed by the university from time to time.

11. IMPROVEMENT OF GRADES

Students who wish to improve the grades in any course after their first successful attempt in that course and secured a complete pass minimum in that course, only shall be permitted to reappear for the improvement of grades (for theory examinations only) without cancelling the earlier examination(s). No improvement shall be permitted for practical examinations. Examination for improving the grades may be conducted along with the subsequent batch. Improvement of a particular semester can be done only once. If a candidate fails to appear for the improvement examination after registering or if there is no change in the marks of the improvement examination, then the marks obtained in the first appearance shall be retained.

9. INDIRECT GRADING SYSTEM

Indirect Grading system shall be implemented for this programme, the details of which are given below.

Method of Indirect Grading:
Evaluation (both internal and external) is carried out using Mark system .The grading on the basis of a total internal and external marks will be indicated for each course and for each semester and for the entire programme.

Indirect Grading System in 7 point scale is given in Table No: 1 of Annexure III.

The **Grade Point Average** (G) for each course is calculated using the formula:

G= Actual Marks obtained X 6/ 75

In the case of a semester, **Semester Grade Point Average (SGPA)** is calculated as follows:

SGPA= Total Marks obtained in the semester X 6 / Total Marks for that Semester

While preparing the consolidated grade card at the end of the programme, to calculate the **Cumulative Grade Point Average (CGPA)**, we shall use the formulae:

CGPAfor English =Total Marks obtained for English X 6/ 150

CGPA for Mathematical Sciences = Total Marks obtained for Mathematical Sciences(including that of comprehensive viva and individual project) X 6/ 2250

CGPAfor the programme = Total Marks obtained for the entire programme X 6/ 2400

To classify students on the basis of CGPA, Table No: 2 in Annexure III shall be used.

9. SPECIMEN OF THE GRADE CARD AT THE END-SEMESTER EXAMINATION

An illustrative specimen of the grade card to be issued to the candidates after they complete one semester is given in Table No:3 of Annexure III

In the overleaf of the grade card, interpretation on the grades of each course shown in Table No:1 of Annexure III may be given.

10. SPECIMEN OF THE CONSOLIDATED GRADE CARD AT THE END OF THE PROGRAMME

A consolidated grade card may also be issued to a successful candidate at the end of the programme. A specimen in this regard is given in Table No.4 of Annexure III, where the explanations for the asterisks therein are supplied after the table.

In the overleaf of the consolidated grade card, interpretation on the grades shown in Table No:5 of Annexure III may be given.

11. APPLICATION OF REGULATION FOR CHOICE BASED CREDIT AND SEMESTER SYSTEM FOR UNDER GRADUATE CURRICULUM -2014

The Regulations for undergraduate curriculum under choice based credit and semester system with effect from 2014 will be made applicable to B.Sc.(Honours) in Mathematics programme in relation to the operation of clauses which are not specifically mentioned in this part.

12. Course Structure:-

Semester	Code	Course	Credits	Contact Hours	Max. Marks (Int+Ext)	Min marks for pass
Semester 1	BHM101	Communicative English	4 credits	5 Hrs/week	15+60=75	30
	BHM 102	Foundations of Mathematics	4 credits	5 Hrs/week	15+60=75	30
	BHM 103	Differential Calculus	4 credits	5 Hrs/week	15+60=75	30
	BHM 104	Matrices and Probability Theory	4 credits	5 Hrs/week	15+60=75	30
	BHM 105	Two Dimensional Geometry	4 credits	5 Hrs/week	15+60=75	30
Semester 2	BHM 201	Language through Literature	4 credits	5 Hrs/week	15+60=75	30
	BHM 202	Abstract Algebra and Linear Algebra	4 credits	5 Hrs/week	15+60=75	30
	BHM 203	Integral Calculus	4 credits	5 Hrs/week	15+60=75	30
	BHM 204	Theory of Numbers and Equations	4 credits	5 Hrs/week	15+60=75	30
	BHM 205	Graph Theory and Distribution Functions	4 credits	5 Hrs/week	15+60=75	30
Semester 3	BHM 301	Real Analysis	4 credits	5 Hrs/week	15+60=75	30
	BHM 302	Vector Calculus	4 credits	5 Hrs/week	15+60=75	30
	BHM 303	Ordinary Differential Equations	4 credits	5 Hrs/week	15+60=75	30
	BHM 304	Theory of Sampling and Estimation	4 credits	5 Hrs/week	15+60=75	30
	BHM 305	Advanced Linear Algebra	4 credits	5 Hrs/week	15+60=75	30
Comprehensive Viva					**0+50=50**	**20**
Semester 4	BHM 401	Advanced Real Analysis and Metric Spaces	4 credits	5 Hrs/week	15+60=75	30
	BHM 402	Advanced Abstract Algebra	4 credits	5 Hrs/week	15+60=75	30
	BHM 403	Complex Analysis, Fourier Series and Partial Differential Equations	4 credits	5 Hrs/week	15+60=75	30
	BHM 404	Advanced Statistical Techniques	4 credits	5 Hrs/week	15+60=75	30
	BHM 405	Numerical Analysis	4 credits	5 Hrs/week	15+60=75	30
Semester 5	BHM 501	Special Functions	4 credits	5 Hrs/week	15+60=75	30
	BHM 502	Advanced Complex Analysis	4 credits	5 Hrs/week	15+60=75	30
	BHM 503	Advanced Discrete Mathematics	4 credits	5 Hrs/week	15+60=75	30
	BHM 504	Differential Geometry	4 credits	5 Hrs/week	15+60=75	30
	BHM 505	Elective –I	4 credits	5 Hrs/week	15+60=75	30
Semester 6	BHM 601	Mathematical Transforms	4 credits	5 Hrs/week	15+60=75	30
	BHM 602	Integral Equations and Measure Theory	4 credits	5 Hrs/week	15+60=75	30
	BHM 603	Topology	4 credits	5 Hrs/week	15+60=75	30
	BHM 604	Operations Research	4 credits	5 Hrs/week	15+60=75	30
	BHM 605	Elective-II	4 credits	5 Hrs/week	15+60=75	30
		Comprehensive Viva			**0+50=50**	**20**
		Individual Project Work			**10+40=50**	**20**
Total			**120** credits		**2400**	**960**

Elective-I is to be chosen as one of the following courses:

BHM 505 A. Calculus of Variations
BHM 505 B. Programming using Scilab
BHM 505 C. Classical Mechanics
BHM 505D. Mathematical Economics

Elective-II is to be chosen as one of the following courses:

BHM 605 A. Discrete Fourier Analysis
BHM 605 B. Mathematical Finance
BHM 605 C. Fuzzy Mathematics
BHM 605 D. Automata Theory

13. WORKLOAD PER WEEK

Subject	1and II Sem	III and IV Sem	V and VI Sem
English	5 hrs	--	--
Mathematical Sciences	20 hrs	25 hrs	25 hrs
Total	**25 Hrs**	**25 Hrs**	**25 Hrs**

ANNEXURE-III: Tables

Calculation of grades in the case of a course

% of marks obtained	Grade	Interpretation
90 and above	**A+**	Outstanding
80 to below 90	**A**	Excellent
70 to below 80	**B**	Very good
60 to below 70	**C**	Good
50 to below 60	**D**	Satisfactory
40 to below 50	**E**	Pass
Below 40	**F**	Fail

Table No: 1

CGPA	Grade	Interpretation	Class
5.4-6	**A+**	Outstanding	First class with distinction
4.8 and below 5.4	**A**	Excellent	First class with distinction
4.2 to below 4.8	**B**	Very good	First Class
3.6 to below 4.2	**C**	Good	First Class
3 to below 3.6	**D**	Satisfactory	Second Class
2.4 to below 3	**E**	Pass	Pass
Below 2.4	**F**	Fail	Fail

Table No: 2

Course Code	Course	Course Credit	Marks obtained							Grade Point Average (G)	Grade
			Internal *	External				Total			
				Theory	Max	Practical	Maximum marks		Max		
BHM XXX	XXX	4	10	50	60	-	-	60	75	4.80	A
BHM XXX	XXX	4	12	-	-	40	60	52	75	4.16	C
BHM XXX	XXX	4	11	42	60	-	-	53	75	4.24	B
BHM XXX	XXX	4	13	50	60	-	-	63	75	5.04	A
BHM XXX	XXX	4	15	56	60	-	-	71	75	5.68	A+
Comprehensive Viva-Voce			-	40			50	40	50	-	-
Project Work and Viva-Voce			10	35			50	45	50	-	-
TOTAL		20	71	374				445	475	-	-
SGPA = 5.62 (A+)											

Table No: 3

* Note that Internal mark for all courses except for the Project work is 15 marks and internal mark for project work is 10 marks

Subject	Credit	CGPA	Grade
English	8	*	*(1)
Mathematical Sciences	112	**	**(1)
TOTAL	120	***	***(1)
CGPA for the programme		***	***(1)
Overall Grade	****	Class	*****

Table No. 4

Explanation for the asterisks in Table No. 4:

* This entry is calculated using the formula

CGPA for English = Total Marks obtained for English X 6/ 150

*(1) Here grade should be assigned based on the calculations given in Table No. 5

** This entry is computed using the formula

CGPA for Mathematical Sciences = Total Marks obtained for Mathematical Sciences(including that of comprehensive viva and individual project) X 6/ 2250

**(1) Here grade should be assigned based on the calculations given in Table No. 5

*** To calculate this, we shall use the formula:

CGPA for the programme = Total Marks obtained for the entire programme X 6/ 2400

***(1) Here grade should be assigned based on the calculations given in Table No. 5

**** Here grade should be assigned based on the calculations given in Table No. 2

***** The class here should be recorded as per the last column in Table No. 2

Details regarding the grades and computations shall be given in the overleaf of the grade sheet.

GPA for the course	Grade	Interpretation
5.4-6	**A+**	Outstanding
4.8 and below 5.4	**A**	Excellent
4.2 to below 4.8	**B**	Very good
3.6 to below 4.2	**C**	Good
3 to below 3.6	**D**	Satisfactory
2.4 to below 3	**E**	Pass

Table No. 5

14. Detailed Syllabus:-

SEMESTER 1

BHM 101. COMMUNICATIVE ENGLISH

BHM 102. FOUNDATIONS OF MATHEMATICS

Module I(25 Hours)

Fundamental concepts (Contrapositive and converse, Negation excluded.), Functions, Relations, Cartesian products, Countable and uncountable sets, Well-ordered sets. (1.1, 1.2, 1.3, 1.5, 1.7, 1.10 from Text 1)

Module II(10 Hours)

Statements and their combinations, Implications, Contrapositive and converse, Context and quantifiers, Direct proofs, Indirect proofs. (Appendix A from Text 2)

Module III(35 Hours)

Definition, The sphere through four given points, Sphere, Equations of a circle, Intersection of a sphere and a line, Equation of a tangent plane, Angle of intersection of two spheres, Definition, Condition that the general equation of the second degree should represent a cone, Intersection of a line with a cone, Intersection of two cones with a common vertex, The right circular cone, The cylinder, The right circular cylinder, (Sections 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 7.1, 7.2. 7.4, 7.5, 7.6, 7.7, 7.8 from Text 3)

Module IV(20 Hours)

The general equation of the second degree, Shapes of some surfaces, Intersection of a line with a conicoid, Plane of contact, The polar plane of a point, Enveloping cone and cylinder, Chord, Conjugate diameters and diametral planes, Paraboloids.(Sections 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9 from Text 3)

Cylindrical Polar Co-ordinates,Spherical Polar Co-ordinates (Relevant portions from Section 15.7 of Text 4)

Text Books: 1) James R. Munkres, Topology, Second edition, PHI

2) G. Bartle, Donald R. Sherbert : Introduction to Real Analysis (Fourthedition.).

3) Shanti Narayan, P.K.Mittal, Analytical Solid Geometry, S.Chand

4) Thomas &Finney : Calculus, 12th ed., LPE, Pearson Education.

Reference Books:

1. K.H. Rosen: Discrete Mathematics and its Applications (Sixth Edition), Tata McGraw Hill Publishing Company, New Delhi.
2. S. Lipschutz: Set Theory and Related Topics (Second Edition), Schaum Outline Series, Tata McGraw-Hill Publishing Company, New Delhi.
3. T K Manicavachagom Pillai T Natarajan K S Ganapathy: Algebra Vol-1, S Viswanathan printers and publishers, 2010.

BHM 103. DIFFERENTIAL CALCULUS

MODULE I :(25 Hours)

History of calculus [**Not for external examination – Read the Note given at the end of the syllabus of this course**] Chapter 12 from Text 1

Preliminaries- Function quick review, Shifting graphs

2.1 Rate of change and Tangents to Curve
2.2 Limit of a function
2.3 The precise definition of limits
2.4 one-sided limits
2.5 Continuity
2.6 Limits involving ∞ ;Asymptotes of graphs
3.1-3.6 Quick Review of Differentiation
4.1 Extreme value of functions
4.2 The mean value theorem
4.3 Monotonic function and the first derivative test

MODULE II (15 Hours)

4.4 Concavity and curve sketching
4.5 Applied Optimization

[Following sections in this module are from Text 4]

√ 4.1 n^{th} derivatives
√ 4.2 n^{th} derivatives of standard functions
√ 4.3 n^{th} derivatives of rational functions
√ 4.4 Leibnitz Rule

MODULE III TRANSCENDENTAL FUNCTIONS (25 Hours)

6.2 Natural logarithms
6.3 The Exponential function
6.4 a^x and $\log_a x$
6.5 Growth and decay (quick review)
6.6 L' Hopital's Rule
6.7 Relative rates of growth
6.10 Hyperbolic functions

MODULE IV (25 Hours)

12.1 Functions of several variables
12.2 Limits and Continuity
12.3 Partial derivatives
12.4 Differentiability linearization and differentials
12.5 Chain rule
12.6 Partial derivatives with constrained variables
12.8 Extreme value and saddle points
12.9 Lagrange multipliers

Text Books: 1) Victor J Katz**,** A History of Mathematics, An Introduction, 2nd Edition, Addison-Wesley.

2) Thomas &Finney : Calculus, 12th ed., LPE, Pearson Education.

3) S.S. Sastry, Engineering Mathematics, Vol I, 3rd Edition, PHI

4) Balachandra Rao and C K Santha: Differential Calculus

References:

1. Anton : Calculus, Wiley.
2. S.K. Stein : Calculus with Analytic Geometry, McGraw Hill.
3. G. F Simmons: Calculus with Analytic Geometry, 2nd Edition, McGraw Hill

[Note that all sections except those mentioned in Module II and Module III are from Text 2. Text 4 is used in the marked sections in Module II and Text 3 is used in the marked sections in Module III. Text 1 is for giving the learner an opportunity to know few excerpts from the history of calculus which is not meant for external evaluation, but questions from the Chapter 12 may be expected for comprehensive viva-voce in the sixth semester and an assignment should be given from this chapter for the internal evaluation]

BHM 104. MATRICES AND PROBABILITY THEORY

MODULE I – (25 Hours)
1.1 Fundamental operations with vectors
1.2 Dot product
2.1 Solving Linear System using Gaussian elimination
2.2 Gauss Jordan Row Reduction and Reduced raw echelon form
2.3 Equivalent systems, Rank and Row space
MODULE II (20 Hours)
2.4 Inverses of matrices
3.2 (Quick review of section 3.1) Determinants and Row reduction
3.4 Eigenvalues and diagonalization
MODULE III – PROBABILITY (25 Hours)
Random Variables:Introduction, Discrete Random Variables, Probability Distribution for a Discrete Random Variable, ,Mean and Variance of a Discrete Distribution, Continuous Random Variable, Probability Density Function, Cumulative Distribution Function, Mean and Variance of a Continuous Random Variable, Joint Distribution, Conditional Probability Distribution, Independent Random Variables, Joint Probability Function of Continuous Random Variables, Marginal Distribution Function, Conditional Probability Density Function,
[Chapter 2: Sections 2.1 to 2.15]

MODULE IV PROBILITY (20 Hours)
Random Variables:Mathematical Expectation**,** Moments, Skewness, other methods of measuring Skewness, Kurtosis, Moment Generating Function, Properties of Moment Generating Function.
[Chapter 2: Sections 2.16 to 2.22]

Text Book: 1) Stephen_Andrilli, David_Hecker_Elementary_Linear Algebra, Academic Press, 4th Edition, 2010.
2) Probability and Statistics for Science and Engineering by G Shanker Rao, University press, 2011.

References
1) Seymour Lipschutz, Marc Lipson Schaum's Outline of Linear Algebra. 4th Edition 2009

2) Denis Serre , Matrices: Theory and Applications. Springer.

3)Dennis D. Wackerly, William Mendenhall III, Richard L. Scheaffer, Mathematical Statistics with Applications (7th edn) .

4) Robert V Hogg and Allen T Craig, Introduction to Mathematical Statistics, 5th edn, Higher Education Press

5) S. C Gupta and V K Kapur, Fundamentals of Mathematical Sciences, S.Chand Publications.

BHM 105. TWO DIMENSIONAL GEOMETRY

MODULE 1 (20 hrs) Quick Review of Chapter 1 Preliminary- Chapter III Sections III.1 to III.5 (Change of Axes)- Chapter IV Sections IV.1 to IV.4 (Pair of lines)

MODULE II (20hrs) Chapter VII Sections VII. 1 to VII .8 (Parabola)

MODULE III (25hrs) Chapter VII Sections VIII. 1 to VIII .8 (Ellipse) Chapter IX Sections IX. 1 to IX .6 (Hyperbola)

MODULE IV (25hrs) Chapter X Sections X. 1 to X .5 (General Second Degree Equations and Tracing of Conics) Chapter XI Sections XI. 1 to XI .4 (Polar Equation of a conic)

Text Book
P Jain, K Ahmad, Text Book of Analytical Geometry of Two Dimensions, New Age International (P) Ltd., 1996.

References:

1. S. K. Stein, Calculus with Analytic Geometry, McGraw Hill.
2. G. F Simmons, Calculus with Analytic Geometry, 2nd Edition, McGraw Hill.

SEMESTER 2

BHM 201. LANGUAGE THROUGH LITERATURE

BHM 202. ABSTRACT ALGEBRA AND LINEAR ALGEBRA

MODULE I. (20 hrs)

Binary Operation,Groups, Subgroups
(Chapter 1 Sections 2,4,5 of Text 1)

MODULE II. (25 hrs)

Cyclic groups, Groups of permutations, Orbits, cycles and Alternating groups (Theorem 9.15 without proof) (Chapter 1- Sections 6,8,9 of Text1)

Module III (25 Hrs)

Linear Algebra: Introduction, Definition and simple examples of Field. Vector Spaces, Subspaces, Linear Dependence and Linear Independence, Bases and Dimension, Coordinates. (Chapter 2 – 2.1 to 2.4 of Text 2)

Module IV (20 Hrs)

Linear Transformations, The algebra of linear transformations, Isomorphism, Representations of transformations by matrices. (Chapter 3 – 3.1 to 3.4 of Text 2)

Text Books:

Text 1: John B. Fraleigh : A First Course in Abstract Algebra, 7th Ed., Pearson.

Text 2: Kenneth Hoffman & Ray Kunze,Linear Algebra, Second Edition, Prentice Hall of India.

References:

- Joseph A. Gallian : Contemporary Abstract Algebra. Narosa Pub. House.
- M. Artin, Algebra, PHI.
- Stephen H. Friedberg, Arnold J. Insel, Linear Algebra, Second Edition, Lawrence E. Spence, 1989
- R. R. Stoll and E. T. Wong, Linear Algebra , Academic Press International Edn. (1968)
- G. D. Mostow and J.H. Sampson, Linear Algebra, McGraw-Hill Book Co NY (1969)

BHM 203. INTEGRAL CALCULUS

MODULE I – INFINITE SEQUENCES AND SERIES (25 Hours)

10.1Sequence
10.2 Infinite series
10.7 Power Series
10.8 Taylor and Maclaurin's series
10.9 Convergence of Taylor series

MODULE II : REDUCTION FORMULA FOR INTEGRALS (20 Hours)

Reduction Formula for integrals and simple applications of these integrals for evaluating integrals like for $\int sin^n x\, dx, \int cos^n x\, dx, \int sin^m x\, cos^n x\ \ dx, \int_0^{\frac{\pi}{2}} sin^n x\, dx, \int_0^{\frac{\pi}{2}} cos^n x\, dx\ \ \int_0^{\frac{\pi}{2}} sin^m x\, cos^n x\ \ dx, \int tan^n x\, dx, \int se$

and simpleapplications of these integrals for evaluating integrals like $\int_0^{\frac{\pi}{2}} (a^2 - x^2)^n\, dx.$

(Relevant sections from Text 2)

MODULE III– INTEGRATION AND APPLICATIONS-I (25 Hours)

4.5 Riemann sums and definite – integrals
4.6 Properties, area and the mean value theorem.
4.7 The fundamental theorem
4.8 Substitution in definite integrals.
5.1 Areas between curves
5.2 Finding volumes by slicing
5.3 Volumes of solids of revolution (Disk method only)

MODULE IV INTEGRATION AND APPLICATIONS-II (20 Hours)

5.5 Lengths of plane curves
5.6 Areas of surface of revolution
9.9 Integration in polar coordinates
5.7 Moments and centres of mass
5.8 Work

Text Book

1) Thomas &Finney : Calculus, 12th ed., LPE, Pearson Education.
2) Shanti Narayanan, Integral Calculus

References

Anton : Calculus, Wiley.
S.K. Stein : Calculus and Analytic Geometry, McGraw Hill.

BHM 204. THEORY OF NUMBERS AND EQUATIONS

Module I(25 Hours)

The division algorithm, The greatest common divisor, The Euclidean algorithm, The Diophantine equation ax + by = c, The fundamental theorem of arithmetic, The sieve of Eratosthenes. (2.2, 2.3, 2.4, 2.5, 3.1, 3.2 from Text 1)

Module II(30 Hours)

Basic properties of congruence, Linearcongruences and the Chinese remainder theorem, Fermat's little theorem and pseudo primes, Wilson's theorem, The sum and number of divisors. (4.2, 4.4, 5.2, 5.3, 6.1 from Text 1)

Module III – Theory of Equations-I (35 Hours)

Basic concepts, Relation between roots and coefficients, Symmetric functions of roots, Sum of the powers of roots, Newton's Theorem on Sum of the powers of roots, Transformation of equations, Reciprocal equations, Transformation in general, Descartes rule of Signs, Multiple roots, Sturm's theorem, Cardon's method. [Chapters 6: Sec 1 to 10, 11,12,13,14,15,16,21,24,26,27, 34.1 and 35 of Text 2]

Text Books: 1) David M. Burton : Elementary Number Theory, Seventh Edn, TMH.

2) T K Manicavachagom Pillai T Natarajan K S Ganapathy: Algebra Vol-1, S Viswanathan printers and publishers, 2010.

Reference Books:

1. C.Y. Hsiung, Elementary Theory of Numbers, Allied Publishers.
2. N. Robbins, Beginning Number Theory, Second Edition. Narosa.
3. G. E. Andrews, Number Theory, HPC.
4. M.D. Raisinghnia and R.S. Aggarwal, Algebra.
5. K.H. Rosen, Discrete Mathematics and its Applications, 6th Edition, Tata McGraw Hill Publishing Company, New Delhi.

BHM 205. GRAPH THEORY AND DISTRIBUTION FUNCTIONS

Module I(25 Hours)

Fundamental terminology, Connected graphs, Distance in graphs, Isomorphic graphs, Common graphs and graph operations, Multigraphs and digraphs (Sections 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 from text 1)

Module II (20 Hours)

Cut-vertices, bridges and blocks , Trees, Connectivity and edge-connectivty, Menger's theorem (Sections 2.1, 2.2, 2.3, 2.4 from text 1)

MODULE III – DISCRETE PROBABILITY DISTRIBUTIONS (20 Hours)

Probability Distributions (Discrete): Introduction, Binomial Distribution, Poisson Distribution, Discrete Uniform Distribution, Negative Binomial and Geometric Distributions

[Chapter 3 Sections 3.1 to 3.5]

MODULE IV –CONTINOUS PROBILITY DISTRIBUTIONS (25 Hours)

Probability Distributions (Continuous): Continuous Probability Distributions, Exponential and Negative Exponential Distributions, Normal Distribution, Gamma Distribution, Beta Distribution

[Chapter 3: Sections 3.6 to 3.10]

Text Book: 1) Gary Chatrand and Ping Zhang, Chromatic Graph Theory, CRC Press, 2009

2) Probability and Statistics for Science and Engineering by G Shanker Rao, University Press, 2011.

References

1. Dennis D. Wackerly, William Mendenhall III, Richard L. Scheaffer, Mathematical Statistics With Applications (7^{th}edn) .

2 Robert V Hogg and Allen T Craig, Introduction to Mathematical Statistics, 5^{th}edn, Higher Education Press

3 S. C Gupta and V K Kapur, Fundamentals of Mathematical Sciences, S.Chand Publications.

SEMESTER 3

BHM 301. REAL ANALYSIS

MODULE I (25 Hours)

The algebraic property of real numbers – The absolute value and Real line – The completeness property of R – Applications of the supremum property – Intervals.

(Sec. 2.1 to 2.5 of text 1)

MODULE II (25 Hours)

Sequence and their limits - Limit theorems - Monotone sequences - Subsequence and Bolzano-Weirstrass theorem - Cauchy criterion.

(Sec. 3.1 to 3.5 of text 1)

MODULE III (25 Hours)

Introduction to Series – Absolute Convergence – Tests for absolute convergence – Tests fornon absolute convergence.

(Sec. 3.7, 9.1, 9.2, 9.3 of Text 1)

MODULE IV (15 Hours)

Continuous functions (a quick review) - Continuous functions on intervals - Uniform continuity – Continuity and Gauges.

(Sec. 5.3, 5.4, 5.5)

Text 1: Robert G. Bartle & Donald R. Sherbert : Introduction to Real Analysis, 4th ed., Wiley.

References

1. J.M. Howie : Real Analysis, Springer 2007.
2. Ghorpade and Limaye : A Course in Calculus and Real Analysis, Springer, 2006.
3. K.A. Ross : Elementary Real Analysis : The Theory of Calculus, Springer Indian Reprint.
4. J.V. Deshpande : Mathematical Analysis and Applications, Narosa Pub. House.

BHM 302. VECTOR CALCULUS

MODULE 1 (25 Hours)

(A quick review of Section 12.1 to 12.4)
13.1 Curves in Space and Their Tangents
13.3 Arc length in Space
13.4 Curvature and Normal Vectors of a Curve
13.5 Tangential and Normal Components of Acceleration
14.5 Directional derivatives and gradient vectors
14.6 Tangent Planes and Differentials

MODULE 2 (25 Hours)

15.1 Double Integrals
15.4 Double integrals in polar form
15.5 Triple integrals in Rectangular Coordinates
15.7 Triple integrals in cylindrical and spherical co-ordinates.
15.8 Substitutions in multiple integrals.

MODULE 3 (25 Hours)

16.1 Line integrals
16.2 Vector fields and Line Integrals: work,circulation ,and flux
16.3 Path independence, conservativeFields,and potential Functions
16.4 Green's theorem in the plane

MODULE 4 (15 Hours)

16.5 Surface area
16.6 Surface Integrals
14.7 Stokes' theorem (statement only)
16.8 Divergence theorem and unified theory (Statements only).

Text Book: Thomas / Finney : Calculus, 12th ed., LPE, Pearson Education.

References

1. Kreyszig : Advanced Engineering Mathematics, 8th ed., Wiley.
2. H.F. Davis and A.D. Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.

BHM303. ORDINARY DIFFERENTIAL EQUATIONS

Module I:First Order Differential Equations(25 Hours)

1.1 Basic Concepts. Modeling
1.3Separable ODEs. Modeling
1.4Exact ODEs. Integrating Factors
1.5Linear ODEs. Bernoulli Equation. Population Dynamics
16 Orthogonal Trajectories
1.7Existence and uniqueness of solutions (proof omitted)

Module II-Second Order Linear Differential Equations (25 Hours)

2.1 Homogeneous Linear ODEs of Second Order
2.2 Homogeneous Linear ODEs with Constant Coefficients
2.3 Differential Operators.
2.5Euler- Cauchy Equation
2.6Existence and Uniqueness Theory (proof omitted), Wronskian
2.7Non-homogeneous ODEs
2.9 Solution by Variation of parameters

Module III-Higher Order Linear ODEs and Systems of Differential Equations(15 Hours)

3.1 Homogeneous Linear ODEs
3.2 Homogeneous Linear ODEs with Constant Coefficients
3.3 Nonhomogeneous Linear ODEs
4.1 System of ODEs as models
4.2 Basic Theory of Systems of ODEs. Wronskian
4.6 Nonhomogeneous Linear Systems of ODEs

Module IV : Numerical Solutions of Ordinary Differential Equations (25 Hours)

7.1 Introduction
7.2 Solution by Taylor's series
7.3 Picard's method of successive approximations
7.4 Euler's method
7.4.2 Modified Euler's Method
7.5 Runge-Kutta method

Text :1) Erwin Kreyzig, Advanced Engineering Mathematics, 9th Edition, John Wiley, 2006.
2) S.S. Sastry : Introductory Methods of Numerical Analysis, Fourth Edition, PHI.

References

1. S.L. Ross : Differential Equations, 3rd ed., Wiley.
2. A.H. Siddiqi & P. Manchanda : A First Course in Differential Equation with Applications, Macmillan, 2006.
3. E.A. Coddington : An Introduction to Ordinary Differential Equation, PHI.

BHM 304. THEORY OF SAMPLING AND ESTIMATON

MODULE I -SAMPLING DISTRIBUTION (20 Hours)
Introduction, Population, Sample, Methods of Sampling, Standard Error, Probable Error, Central Limit Theorem, Finite Population Correction, Sampling Fluctuations, Sampling Distribution of the Mean(σ Unknown), Standard Errors of Some Parameters.
[Chapter 4, Sections 4.1 to 4.11]

MODULE II – THEORY OF ESTIMATION (25 Hours)
Introduction, Point Estimate, Interval Estimation, Criteria for a Good Estimator, Unbiased Estimator, Efficiency, Sufficiency, Likelihood Function, Principle of Maximum Likelihood, Interval Estimator and Confidence Limits, Estimation of Difference Between Two Means, The Estimator of Proportions, Bayesian Estimation.
[Chapter 5: Sections 5.1 to 5.13]

MODULE III- HYPOTHESIS OF TESTING (30 Hours)
Introduction, Hypothesis, Hypothesis Testing, Types of Hypothesis, Computation of a Test Statistic, Level of Significance, Critical Region, One Tailed and Two Tailed Tests, Errors, Procedure for Hypothesis Testing, Important Tests of Hypothesis, Critical values, Tests of Significance : Large Samples. [Chapter 6: Sections 6.1 to 6.13]

MODULE IV- HYPOTHESIS OF TESTING (15 Hours)
Test of Significance for a Single Proportion, Testing of Significance for a Difference of Proportions.
[Chapter 6: Sections 6.13 to 6.15]

Text Book: Probability and Statistics for Science and Engineering by G Shanker Rao, University Press, 2011.

References: 1) Robert V Hogg and Allen T Craig, Introduction to Mathematical Statistics, 5th edn, Higher Education Press
2) S. C Gupta and V K Kapur, Fundamentals of Mathematical Sciences, S.Chand Publications.

BHM 305. ADVANCED LINEAR ALGEBRA

Module I(25 Hours)

Linear Transformations (Quick review only), The double dual, Transpose of a linear transformation, Characteristic values, Annihilating polynomials, Invariant subspaces. (3.6, 3.7, 6.1 to 6.4)

Module II(25 Hours)

Simultaneous Triangulation, Simultaneous diagonolisation, Invariant direct sums, The Primary Decomposition Theorem.

Module III(20 Hours)

Inner products, Inner product spaces, Orthogonal basis, Orthonormal basis, Gram-Schmidt othogonalisation (8.1, 8.2)

Module IV(20 Hours)

Linear Functions, Adjoints, Self adjoint operators, Unitary operators, Normal operators.(8.3, 8.4, 8.5)

Text Book: Kenneth Hoffman & Ray Kunze, Linear Algebra, Second Edition.

Reference Books:

1. Stephen H. Friedberg, Arnold J. Insel, Linear Algebra, Second Edition, Lawrence E. Spence, 1989
2. R. R. Stoll and E. T. Wong, Linear Algebra , Academic Press International Edn. (1968)
3. G. D. Mostow and J.H. Sampson, Linear Algebra, McGraw-Hill Book Co NY (1969)
4. Stephen H. Friedberg, Arnold J Insel and Lawrence E. Spence: Linear Algebra: 4th Edition 2002: Prentice Hall.

SEMESTER 4

BHM 401. ADVANCED REAL ANALYSIS AND METRIC SPACES

Module I: Riemann Integral (25 Hours)

Riemann Integral, Riemann Integrable Functions, The fundamental theorem, Substitution theorem and application(Text 1: Sec. 7.1, 7.2, 7.3 (up to 7.3.9)).

Module II: Sequence and series of functions (25 Hours)

A quick review of series of real numbers, Point wise and uniform convergence, Interchange of limit and continuity, Interchange of limit and derivative, Interchange of limit and integral, Series of functions(Text 1: Sections: 8.1.1 to 8.1.10, 8.2.1, 8.2.2, 8.2.3, 8.2.4, 9.4.1to 9.4.13)

Module III: Metric Spaces(20 Hours)

Some inequalities of R, Metric spaces, Sequences in Metric spaces, Cauchy sequences, Complete metric spaces(Text 2: Sections: 1.1 to 1.4)

Module IV : Topology of Metric Spaces(20 Hours)

Open and closed sets, Interior and Closure of a set, Limit points, Subspaces, Continuous mappings. (Text 2: Sections: 2.1, 2.2, 3.1)

Text Book:

1. Robert G. Bartle, Donald R. Sherbert-*Introduction to Real Analysis* (4^{th}Edn.), Wiley, India.
2. SatishShirali and Harkrishan L. Vasudeva – *Metric Spaces* – Springer.

Reference Books:

1. J.V. Deshpande -*Mathematical Analysis and Applications*, NarosaPub.House.
2. Torence Tao -*Analysis I*, TRIM 37, Hindustan Book Agency.
3. K.A. Ross -*Elementary Real Analysis: Theory of Calculus*, Springer.
4. K.G. Binmore -*Mathematical Analysis*, CUP.
5. T. M. Apostol - *Mathematical Analysis*, 2_{nd} Edition, Addison- Wesley.
6. G. F. Simmons – *Introduction to Topology and Modern Analysis* – Tata McGraw Hill.
7. MichealOSearcoid – *Metric Spaces* – Springer.
8. C.G.C. Pits - *Introduction to Metric Spaces* – Oliver & Boyd Edinburgh

BHM 402. ADVANCED ABSTRACT ALGEBRA

MODULE I(20 hrs)

Cosets and Theorem of Lagrange,Homomorphisms (Text 1: Sections: 10 and 13)

Module II (25 Hours)

Factor Groups, Factor Group Computations and Simple Groups (Text 1: Sections: 14 and 15)

Module III (25 Hours)

Rings and Fields, Integral Domains,Fermat's and Euler's theorems

Module IV (20 Hours)

Rings of Polynomials, Factorization of Polynomials over a Field

Text :

1.FRALEIGH, J.B. **: A FIRST COURSE IN ABSTRACT ALGEBRA.**
(7th Edition.) Pearson (2003.)

References:

1. I.N. Herstein : Topics in Algebra Wiley Eastern (Reprint)
2. N.H. Mc Coy and R.Thomas : Algebra. Allyn & Bacon Inc. (1977).
3. J. Rotman : The Theory of Groups Allyn & Bacon Inc. (1973)
4. Hall,Marshall : The Theory of Groups. Chelsea Pub. Co. NY. (1976)
5. Clark, Allan : Elements of Abstract Algebra Dover Publications (1984)
6. L.W. Shapiro : Introduction to Abstract Algebra McGraw Hill Book Co. NY (1975)

BHM 403. COMPLEX ANALYSIS, FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS

Module I(25 Hours)

Exponential form, products and powers in exponential form, arguments of products and quotients, Roots of complex numbers, Regions in the complex plane, Functions of a complex variable, Mappings, Mappings by the exponential function, Limits, Theorems on limits, Limits involving the point at infinity, Continuity, Derivatives, Differentiation formulas (Sections 6 to 20 from Text 1)

Module II(25 Hours)

Cauchy-Riemann equations, Sufficient conditions for differentiability, Analytic functions, Harmonic functions, Uniquely determined analytic functions, The exponential function, The logarithmic function, Branches and derivatives of logarithms, some identities involving logarithms, complex exponents, Trigonometric functions, Hyperbolic functions, (Sections 21, 22, 24 to 27, 29 to 35 from Text 1)

Module III – Fourier Series (20 Hours)

Fourier Series, Functions of any period p=2L, Even and Odd functions, Half- Range Expansion Complex Fourier Series.(Sections 11.1 to 11.4 from Text 2)

Module IV – Partial Differential Equations (20 Hours)

Basic Concepts, Modelling: Vibrating strings, Wave Equation, Separation of Variables. Use of Fourier Series,D'Alembert's Solution of the Wave Equation, Heat Equation: Solution by Fourier Series.(Sections 12.1 to 12.5 fron Text 2)

Texts:

1)James Ward Brown and Ruel V. Churchill : Complex Variables and Applications 8 thEdn, McGraw Hill.

2) Erwin Kreyzig, Advanced Engineering Mathematics, 9th Edition, John Wiley, 2006.

References:

1. G. Birkhoff& G.C. Rota : Ordinary Differential Equations Edn. Wiley & Sons 3rd Edn (1978)

2. E.A. Coddington : An Introduction to Ordinary Differential EqutionsPrintice Hall of India, New Delhi (1974)

3. Courant R and Hilbert D : Methods of Mathematical Physics , vol I, Wiley Eastern Reprint (1975)

4. W.E. Boyce & R.C. Deprima : Elementary Differential Equations and boundary value problems, John Wiley & Sons NY 2nd Edn (1969)

BHM 404. ADVANCED STATISTICAL TECHNIQUES

MODULE I- $\chi 2$-DISTRIBUTION (25 Hours)
Introduction, Contingency Table, calculations of Expected Frequencies, $\chi 2$-Distribution, Mean and Variance of $\chi 2$-Distribution, Additive Property of an Independent $\chi 2$- Variate, Degrees of Freedom, Conditions for Using **χ2-**Test, Uses of **χ2-**Test.
[Chapter 7 Sections 7.1 to 7.9]

MODULE II –TEST OF SIGNIFICANCE-SMALL SAMPLES (25 Hours)
Introduction, Moments about Mean, Properties of t-Probability Curve, Assumption for t-Test, Uses of t-Distribution, Interval Estimate of Population Mean, Types of t-Test, Significant Values of t, Test of Significance of a Single Mean, Student's t-Test for Difference of Means, Paired t-Test, F-Distribution.
[Chapter 8, Sections 8.1 to 8.12]

MODULE III – CURVE FITTING (15 Hours)
Introduction, Straight Line, Fitting a Straight Line, Fitting a Parabola, Exponential Function.
[Chapter 9: Sections 9.1 to 9.5]

MODULE IV-CORRELATION AND REGRESSION (25 Hours)
Introduction, Correlation, Coefficient of Correlation, Methods of Finding the Coefficient of Correlation, Scatter Diagram, Direct Method, Spearman's Rank Correlation Coefficient, Calculation of r by Karl Pearson's Formula, Regression, Regression Equation, Curve of Regression, Types of Regression, Regression Equations, Angle Between Two Lines of Regressions, Multi Linear Regression, Uses of Regression Analysis.
[Chapter 10: Sections 10.1 to 10.16]

Text Book: Probability and Statistics for Science and Engineering by G Shanker Rao, University Press, 2011.

References: 1) Robert V Hogg and Allen T Craig, Introduction to Mathematical Statistics, 5thedn, Higher Education Press
2) S. C Gupta and V K Kapur, Fundamentals of Mathematical Sciences, S.Chand Publications.

BHM 405.NUMERICAL ANALYSIS

Module I : Solution of Algebraic and Transcendental Equation (25 Hours)

2.1 Introduction
2.2 Bisection Method
2.3 Method of false position
2.4 Iteration method
2.5 Newton-Raphson Method
2.6 Ramanujan's method
2.7 The Secant Method

Module II: Finite Differences (20 Hours)

3.1 Introduction
3.3.1 Forward differences
3.3.2 Backward differences
3.3.3 Central differences
3.3.4 Symbolic relations and separation of symbols
3.5 Differences of a polynomial

Module III : Interpolation (25 Hours)

3.6 Newton's formulae for intrapolation
3.7 Central difference interpolation formulae
3.7.1 Gauss' Central Difference Formulae
3.9 Interpolation with unevenly spaced points
3.9.1 Langrange's interpolation formula
3.10 Divided differences and their properties
3.10.1 Newton's General interpolation formula
3.11 Inverse interpolation

Module IV: Numerical Differentiation and Integration (20 Hours)

6.1 Introduction
6.2 Numerical differentiation (using Newton's forward and backward formulae)
6.4 Numerical Integration
6.4.1 Trapezoidal Rule
6.4.2 Simpson's 1/3-Rule
6.4.3 Simpson's 3/8-Rule

Text :

S.S. Sastry : Introductory Methods of Numerical Analysis, Fifth Edition, PHI.

References

1. S. SankaraRao : Numerical Methods of Scientists and Engineer, 3rd ed., PHI.
2. F.B. Hidebrand : Introduction to Numerical Analysis, TMH.
3. J.B. Scarborough : Numerical Mathematical Analysis, Oxford and IBH.

SEMESTER 5

BHM 501. SPECIAL FUNCTIONS

Module I-Power Series Solutions and Special Functions (25 Hours)
26. Introduction. A Review of Power Series
27. Series Solutions of First Order Equations
28. Second Order Linear Equations. Ordinary Points
29. Regular Singular Points
30. Regular Singular Points (Continued)
Module II- Power Series Solutions and Special Functions continued(20)
31. Gauss's Hypergeometric Equation
32. The Point at Infinity
(Statements only for all the theorems in module 1 and II)
Module III-Some Special Functions of Mathematical Physics(25 Hours)
44. Legendre Polynomials
45. Properties of Legendre Polynomials
46. Bessel Functions. The Gamma Function
47 . Properties of Bessel functions
Module IV – Improper Integrals, Beta and Gamma Functions (20 Hours)
Improper integrals, Improper integrals of first, second and third kinds, Cauchy principal value, Beta and Gamma function and properties. (Chapter 12 and 13 of Text 2)

Texts:

1) **Simmons, G.F.**,:Differential Equations with Applications and Historical Notes, Second edition, McGraw Hills, 1974.
2) M.R. Spiegel, Theory and Problems of Advanced Calculus, Schaum's Series.

References:

1. G. Birkhoff& G.C. Rota : Ordinary Differential EquationsEdn. Wiley & Sons 3rd Edn (1978)
2. E.A. Coddington : An Introduction to Ordinary DifferentialEqutionsPrintice Hall of India, New Delhi (1974)
3. Courant R and Hilbert D : Methods of Mathematical Physics , vol I, Wiley Eastern Reprint (1975)
4. W.E. Boyce & R.C. Deprima : Elementary Differential Equationsand boundary value problems, John Wiley & Sons NY 2nd Edn (1969)

BHM 502. ADVANCED COMPLEX ANALYSIS

Quick review of the portions upto Analytic functions from BHM 403

Module I: Integrals (30 hrs)

Derivatives of Functions *w(t),* Definite Integrals of Functions *w(t),* Contours, Contour Integrals, Examples with Branch Cuts, Upper Bounds for Moduli of Contour Integrals, Antiderivatives, Cauchy–Goursat Theorem (Excluding proof), Simply Connected Domain, Multiply Connected Domains, Cauchy Integral Formula, An Extension of the Cauchy Integral Formula, Some Consequences of the Extension, Liouville's Theorem and the Fundamental Theorem of Algebra, Maximum Modulus Principle.

Chapter 4: Sections 37 to 46, 48 to 54.

Module II: Series (20 hrs)

A quick review of convergence of sequence and series of complex numbers, Taylor series, Laurents series, Applications, Power series: Absolute and uniform convergence, Continuity of sum of power series, Differentiation and integration of power series.

Chapter 5: Sections 55 to 66.

Module III: Residues & Poles (20hrs)

Isolated singular points, Residues, Cauchy's residue theorem, Residue at infinity, Three types of isolated singular points, Residues at poles, Zeroes of analytic functions, Zeroes and poles, Behavior of Functions near isolated singular points. Chapter 6: Sections: 68 to 77.

Module IV: Applications of Residues (20hrs)

Evaluation of Improper Integrals, Jordan's Lemma (without proof), Indented Paths, An Indentation Around a Branch Point, Integration Along a Branch Cut, Definite Integrals Involving Sines and Cosines, Argument Principle, Rouché's Theorem. Chapter 7: Sections – 78, 79, 81 to 87.

Text: James Ward Brown and Ruel V. Churchill : Complex Variables and Applications (8th Edn.), McGraw Hill.

References

1. Mark J.Ablowitz and Anthanassios S. Fokas: Complex Variables, Cambridge Text, 2nd Edn.
2. S. Ponnusamy: Foundation of Complex Analysis :Narosa.
3. Murray R. Spiegel: Complex Variables, Schaum's Outline series.
4. J.M. Howie: Complex Analysis: Springer India Reprint.
5. Stewart & Tall: Complex Analysis, CUP.

BHM 503. ADVANCED DISCRETE MATHEMATICS

Module I: Eulerian and HamiltonianGraphs(20 Hours)

3.1 Eulerian Graphs.

3.2 DeBruijn Graphs.

3.3 Hamiltonian Graphs.

(Sections FromText 1)

Module II:Matchings and Factorisation(25 Hours)

4.1 Machings. (Proof of theorem 4.5 excluded)

4.2 Independence in Graphs.

4.3 Factors and Factorisation.

(Sections FromText 1)

Module III :Combinatorics-I (20 Hours)
8.1 The Principle of Inclusion and Exclusion
8.2 Generalizations of the Principle
8.3 Derangements: Nothing Is in Its Right Place
8.4 Rook Polynomials
8.5 Arrangements with Forbidden Positions
Module IV: Combinatorics-II (25 Hours)
9.1 Generating Functions -Introductory Examples
9.2 Definition and Examples: Calculational Techniques
9.3 Partitions of Integers
9.4 The Exponential Generating Function

Text Books: 1).Gary Chartrand and Ping Zhang, Chromatic Graph Theory, CRC Press, 2009.

2)Ralph P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction, 5th Edition, Pearson Education, Inc. 2004.

Reference Books:

1. J.A. Bondy and U.S.R.Murty : Graph Theory with applications. Macmillan
2. F. Harary : Graph Theory, Narosa publishers
3. John Clark and Derek Allan Holton : A First look at Graph Theory, Prentice Hall
4. K.R. Parthasarathy : Basic Graph Theory, Tata-McGraw Hill
5. R. Balakrishnan& K. Ranganathan : A Text Book of Graph Theory, Springer Verlag.
6. L. Lovász, et. al., Discrete Mathematics: Elementary and Beyond, Springer

BHM 504. DIFFERENTIAL GEOMETRY

Module I(30 Hours)
Chapter 1 Graphs and Level Sets
Chapter 2 Vector Fields
Chapter 3 The Tangent Space

Module II(30 Hours)

Chapter 4 Surfaces
Chapter 5 Vector Fields on Surfaces; Orientation
Chapter 7 Geodesics

Module III(30 Hours)

Chapter 8 Parallel Transport
Chapter 9 The Weingarten Map
Chapter 10 Curvature of Plane Curves

Text Book :John A. Thorpe, Elementary Topics in Differential Geometry, Springer, 1979.

BHM 505. ELECTIVE-I

Elective-I is to be chosen as one
of the following courses:
BHM 505 A. Calculus of Variations
BHM 505 B. Programming using Scilab
BHM 505 C. Classical Mechanics
BHM 505 D. Mathematical Economics

(See the syllabi of these courses in Annexure-I)

SEMESTER 6

BHM 601. MATHEMATICAL TRANSFORMS

MODULE I (25 Hours) – LAPLACE TRANSFORMS(25 Hours)
6.1 Laplace Transform. Inverse Transform. Linearity. s-Shifting
6.2 Transforms of Derivatives and Integrals. ODEs
6.3 Unit Step Function. t-Shifting
6.4 Short Impulses. Dirac's Delta Function. Pmiial Fractions
6.5 Convolution. Integral Equations
6.6 Differentiation and Integration of Transforms.
6.7 Systems of ODEs
MODULE II– FOURIER INTEGRAL AND TRANSOFRMS(20 Hours)
11.7 Fourier Integrals
11.8 Fourier Cosine and Sine Transforms
11.9 Fourier Transform (Exclude Discrete and Fast Fourier Transforms)
Module III – HENKEL AND MELLIN TRANSFORMS (25 Hours)
7.1 Introduction .
7.2 The Hankel Transform and Example
7.3 Operational Properties of the HankelTransform .
8.1 Introduction .
8.2 Definition of the Mellin Transform and Examples .
8.3 Basic Operational Properties of MellinTransforms .

IV – Z TRANSFORMS (20Hours)
12.1 Introduction
12.2 Dynamic Linear Systems and Impulse Response .
12.3 Definition of the Z Transform and Example
12.4 Basic Operational Properties of Z Transform
12.5 The Inverse Z Transform and Examples .
12.6 Applications of Z Transforms to Finite Difference Equations .
12.7 Summation of Infinite Series .

Texts:

1) Erwin Kreyzig, Advanced Engineering Mathematics, 9th Edition, John Wiley, 2006
2) LokenathDebnath,DambaruBhatta:IntegralTransforms andTheir Applications,Second Edition Chapman & Hall/CRC 2007

References:

Larry C. Andrews,Bhimsen K. Shivamoggi: Integral Transforms for Engineers

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BHM 602. INTEGRAL EQUATIONS AND MEASURE THEORY

MODULE I (30 Hours) – INTEGRAL EQUATIONS

Introduction,Relation Between differential and Integral Equation, The Green's Function, Frdholm Equation With Separable Kernels, Illustrative Examples, Hilbert Schmidt Theory, Iterative Methods for Solving Equations of the Second Kind.

(Sections 3.1 – 3.3, 3.6 – 3.11 from the Text 1)

Module – II (20 Hours)

Introduction:Reasons for the development of the Lebesgue integral,comparison with the Riemann integral, the extended realnumber system

Measurable Functions: Introduction – Measurable sets and functions, Combinations – Complex valued functions, functions between measurable spaces.

(Chapter 1, 2 from Text 2)

Module – III(25 Hours)

Measures – Measure Almost everywhere – Charges

The Integral: Simple Functions and their Integrals – The integral of a non-negative extended real-valued measurable function – the Monotone Convergence Theorem – Fatou's Lemma – Properties of the integral

(Chapter3 4 from Text 2)

Module – IV (15 Hours)

Integrable Functions: Integrable real-valued functions – Positivity and linearity of theintegral – The Lebesgue Dominated Convergence Theorem

(Chapter 5 from TextDependence of parameter omitted)

Texts:

1) Francis B. Hildebrand, Methods of Applied Mathematics, Second Edn., PHI

2) Bartle R G : The Elements of Integration and Lebesgue Measure : John Wilwy& sons Inc. 1995

References:

1. Walter Rudin : Principles of Mathematical Analysis : Mc Grow Hill International.
2. Royden : Real Analysis : Pearson
3. T. Apostol: Mathematical Analysis,

BHM603. TOPOLOGY

MODULE 1 (25 HOURS)

(A quick review of metric spaces)

4.1 Definition of a Topological Space

4.2 Examples of Topological Spaces

4.3 Bases and Sub-bases

4.4 Subspaces

MODULE 2 (25 Hours)

5.1 Closed sets and Closure

5.2 Neighbourhoods, Interior and Accumulation Points

5.3 Continuity and Related Concepts

MODULE 3(20 Hours)

6.1 Smallness conditions on a Space (Excluding the proof of Theorem 1.16)

6.2 Connectedness

MODULE 4 (20 Hours)

7.1 Hierarchy of Separation Axioms

7.2 Compactness and Separation Axioms (Up to Corollary 2.10)

7.3 The Urysohn Characterisation of Normality (statement only)

7.4 Tietze Characterisation of Normality (Statement only)

Text Book: James R. Munkres – *Topology A First Course*, 2nd edition – Prentice Hall of India.

Reference Books:

1. C. Wayne Patty, *Foundations of Topology*, Second Edition – Jones &BartlettIndiaPvt. Ltd., New Delhi, 2012.
2. K. D. Joshi, *Introduction to General Topology*, New Age International (P) Ltd.Publishers.
3. G. F. Simmons, *Introduction to Topology and Modern Analysis*, McGraw Hill.
4. S. Willard, *General Topology* , Addison Wesley Publishing Company.

BHM 604. OPERATIONS RESEARCH

MODULE I (25Hours) – The Simplex Method and Sensitivity Analysis
3.1 LP Model in Equation Form
3.2 Transition from Graphical to Algebraic Solution
3.3 The Simplex Method
3.4 Artificial Starting Solution
3.5 Special Cases in the Simplex Method.
MODULE II (20 Hours) – Duality and Post Optimal Analysis
4.1 Definition of the Dual Problem
4.2 Primal-Dual Relationship
4.3 Economic Interpretation of Duality
4.4 Additional Simplex Algorithms
4.5 Post Optimal Analysis.
MODULE III (20 Hours) – Transportation Model and Its Variants
5.1 Definition of the Transportation Model
5.2 Non Traditional transportation Models
5.3 The transportation Algorithm
5.4 The Assignment Model
5.5 The Transportation Model.
MODULE IV (25Hours)- Network Models
6.1 Scope and Definition of Network Models
6.2 Minimal Spanning Tree Algorithms
6.3 Shortest Route Problem
6.4 Maximal Flow Model
6.5 CPM and PERT
Text:
HAMDY A THAHA OPERATIONS RESEARCH, AN INTRODUCTION, 8TH EDITION, PEARSON PRNTICE HALL
References
1. **J.K.Sharma**(2001).Operations Research Theory and Applications.McMillan New Delhi.
2. **Hadley,G.**(1964).Linear Programming,Oxford&IBH Publishing Company,New Delhi.
3. **KantiSwaroop,P.K. Gupta** et.al**,**(1985),Operation Research,Sultan Chand & Sons.

BHM 605. ELECTIVE-II

Elective-II is to be chosen as one of the following courses:
BHM 605 A. Discrete Fourier Analysis
BHM 605 B. Mathematical Finance
BHM 605 C. Fuzzy Mathematics
BHM 605 D. Automata Theory

(See the syllabi of these Elective courses in Annexure II)

<u>ANNEXURE-I:</u> Electives for the fifth semester

BHM 505 A.   CALCULUS OF VARIATIONS

MODULE I- The Method of Variations in Problems with Fixed Boundaries.

1. Variation and its properties.
2. Euler's Equation.
3. Functionals Dependent on Several Dependent Variables.
4. Functionals Dependent on Higher Order Derivatives.
5. Functionals Dependent on Several Independent Variables.
6. Variational Problems in Parametric Form.
7. Some Applications.

(Chapter 6, Sections 1 to 7 of the text. **25 Hours**)

MODULE II- Variational Problems with Moving Boundaries.

1. An Elementary Problem with Moving Boundaries.
2. The Moving Boundary Problem for Functionals with Integrand of the form F(x,y,z,y',z').
3. Extremals with Corners.
4. One Sided Variations.

(Chapter 7, Sections 1 to 4 of the text. **25 Hours**)

MODULE III-Sufficient Conditions for an Extremum.

1. Field of Extremals.
2. The Function E(x,y,p,y').
3. Transforming the Euler Equations to the Canonical Form.

(Chapter 8, Sections 1 to 3 of the text. **20 Hours**)

MODULE IV- Variational Problems Involving Conditional Extremum.

1. Constraints of the Form $\varphi(x,y_1,y_2,\ldots,y_n) = 0$.
2. Constraints of the Form $\varphi(x,y_1,y_2,\ldots,y_n, y_1',y_2',\ldots,y_n') = 0$.
3. Isoperimetric Problems.

(Chapter 9, Sections 1 to 3 of the text. **20 Hours**)

Text :**Differential Equations and Calculus of Variations** : L. Elsgolts, MIR Publishers 1970

Reference: Calculus of Variations : I.M.Gelfand and S.V.Fomin

BHM 505 B. PROGRAMMING USING SCILAB

1. Introduction to Scilab and commands connected with matrices.

2. Computations with matrices.

3. Row reduced echelon form and normal form.

4. Establishing consistency or otherwise and solving system of linear equations.

5. Scilabcommands for plotting functions.

6. Plotting of standard Cartesian curves using Scilab.

7. Plotting of standard Cartesian curves using Scilab.

8. Plotting of standard Polar curves using Scilab.

9. Plotting of standard parametric curves using Scilab.

LIST OF PROGRAMS

1. Creating a Scilab program (simple examples).

2. Verification of Euler's theorem, its extension and Jacobian.

3. Scilab programs to illustrate left hand and right hand limits for discontinuous functions.

4. Scilab programs to illustrate continuity of a function.

5. Scilab programs to illustrate differentiability of afunction. finding Taylor's series for a given function.

6. Evaluation of limits by L'Hospital's rule using Scilab.

7. Obtaining partial derivatives of some standard functions

8. Maxima commands for reduction formula with or without limits.

9. Solution of Differential equation using Scilab and plotting the solution-I.

10. Solution of Differential equation using Scilab and plotting the solution-II.

11. Solution of Differential equation using Scilab and plotting the solution-III.

12. Solution of Differential equations using Scilab and Plotting the solution-IV.

13. Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.

14. Solving second order linear partial differential equations in two variables with constant coefficient.

15. Solutions to the problems on total and simultaneous differential equations.

16. Solutions to the problems on different types of Partial differential equations.

17. Evaluation of the line integral with constant limits.

18. Evaluation of the line integral with variable limits.

19. Evaluation of the double integral with constant limits.

20. Evaluation of the double integral with variable limits.

21 Evaluation of the triple integral with constant limits.

22..Evaluation of the triple integral with variable limits.

23. Scilab programs for area and volume.

Text: C Bunks, J.-P. Chancelier, F. Delebecque, C. Gomez, M. Goursat,R. Nikoukhah, and S. Steer.

Engineering and Scienti_c Computing With Scilab.Birkhauser Boston, 1999.

Reference: 1) TheScilab Consortium. Scilab. http://www.scilab.org.

2) Introduction to Scilab

BHM 505 C. CLASSICAL MECHANICS

MODULE- I(25 Hours)

Basic Concept of Mechanics: - Fundamental laws of Newtonian mechanics, inertial frame of reference, particle, mass, rigid body force, external and internal forces, forces acting at a point, triangle law of forces and polygon law of forces, Lami's theorem, equilibrium of a system of particles, necessary conditions for equilibrium of forces.

MODULE- II(25 Hours)

Moments, moment of a force about a point and a line, parallel forces, couple, theorem of Varignon, Necessary conditions for equilibrium (moment), Coplanar forces, Reduction of a general plane force system, parallel force system in two and three dimensions.

MODULE- III(20 Hours)

Centre of gravity and centre of parallel forces, Centre of gravity of some simple bodies: rod, triangle, arc, plane area, surface of revolution, sum of difference of two bodies, segment of a sphere and some simple curves, Work and Energy, Conservative field and potential energy, Principle of conservation of energy for a particle.

MODULE- I(20 Hours)

Components of velocity and acceleration (Cartesian, radial and transverse, tangential and normal), uniformly accelerated motion, Resisted motion, Projectile and motion in a non-resisting medium, Constrained motion on a smooth vertical circle, collisions (direct).

Text Books:

- Statics, A. S. Ramsey, Cambridge University Press
- A Text book of Dynamics, F. Chorlton, CBS Publishers & Distributors Pvt Ltd

References:

- Dynamics Part-1 and 2, A. S. Ramsey, Cambridge University Press.
- Classical Mechanics, Goldstein, Pearson Education.
- Principle of Mechanics, Synge and Griffith, Mcgraw-Hill Book Company

BHM 505 D. MATHEMATICAL ECONOMICS

MODULE –I (25 Hours) – Equilibrium Analysis in Economics

3.1 The Meaning of Equilibrium

3.2 Partial Market Equilibrium- A linear Model

3.3 Partial Market Equilibrium- A non-linear Model

3.4 General Market Equilibrium

3.5 Equilibrium in National Income Analysis

MODULE –II (20 Hours) – Matrix Analysis

5.6 Applications to Market and National Income Models

5.7 Leontif Input-Output Model

MODULE –III (25 Hours) – Further topics in Optimization

13.1 Non-linear Programming and Kuhn-Tucker Conditions

13.2 The Constraint Qualification

13.3 Economic Applications

13.4 Sufficiency Theorems in Non-linear Programming

MODULE –IV (20 Hours) – Applications of Integration

14.5 Some Economic Applications of Integrals

14.6 Domar Growth Model

Text : Alpha C Chiang, Kevin Wainwright, Fundamental Methods of Mathematical Economics, 4th Edition, 2005

ANNEXURE-II: Electives for the sixth semester

BHM 605 A. DISCRETE FOURIER ANALYSIS

MODULE I (20 Hours)

1. Definition and basic properties of Discrete Fourier Transform.
2. Translation invariant linear transformations.

(Chapter 2, Sections 1 and 2 of the text.)

MODULE II (25 Hours)

1. Construction of First Stage Wavelets on Z_N.
2. The iteration step for Wavelets on Z_N.
3. Daubechies's D6 Wavelets on Z_N.

(Chapter 3, Sections 1 and 2 and example 3.35 of the text.)

MODULE III (25 Hours)

1. Spaces $l^2(Z)$ and $L^2([-\pi, \pi])$ and Fourier Series.
2. The Fourier Transform and Convolution on $l^2(Z)$.

(Chapter 4, Sections 1 ,3 and 4 of the text.)

MODULE IV (20 Hours)

1. First Stage Wavelets on Z.
2. The iteration step for Wavelets on Z.

(Chapter 4, Sections 5 and 6 of the text.)

Text: An Introduction to Wavelets through Linear Algebra: Michael W. Frazier. (Springer 1999)

Reference: Discrete Fourier Analysis: M.W.Wong. (Birkhauser 2010)

BHM 605 B. MATHEMATICAL FINANCE

MODULE I- (25 Hours)

2.3 Finance (2.3.1-2.3.5 of Text 1)

5.6 Some Applications of Integration (5.6.1-5.6.3 of Text 1)

MODULE II – (20 Hours)

12.4 Linear difference equations (12.4.1- 12.4.3 of Text 1)

10 Consumer Mathematics (10.1 -10.4 of Text 2)

MODULE III – (20 Hours)

6 The Arbitrage Theorem (6.1-6.3 of Text 3)

7 The Black–Scholes Formula (7.1-7.3 of Text 3)

MODULE IV – (25 Hours)

10 Stochastic Order Relations (10.1-10.5 of Text 3)

Texts: 1) Frank Verner and Yuri N Sotskov, Mathematics of Economics and Business, Routledge Publications, 2006.

2) Timothy J Biehler, The Mathematics of Money, The McGraw Hill Company, 2008.

3) SHELDON M. ROSS. An elementary introduction to mathematical finance, Cambridge University Press 2011

BHM 605 C. FUZZY MATHEMATICS

MODULE I (25 Hours)

1.3 Fuzzy Sets: Basic Types

1.4 Fuzzy Sets: Basic Concepts

1.5 Characteristics and Significance of the Paradigm Shift

2.1 Additional Properties of alpha-Cuts

MODULE II (20 Hours)

2.2. Representations of Fuzzy Sets

2.3 Extension Principle for Fuzzy Sets

3.1 Types of Operations

3.2 Fuzzy Complements

3.3 Fuzzy Intersections: t-Norms

MODULE III (20 Hours)

3.4 Fuzzy Unions: t-Conorms

3.5 Combinations of Operations

3.6 Aggregation Operations

MODULE IV (25 Hours)

4,1 Fuzzy Numbers

4,2 Linguistic Variables

4.3 Arithmetic Operations on Intervals

4.4 Arithmetic Operations on Fuzzy Numbers

Text: GEORGE J. KLIR AND BO YUAN, FUZZY SETS AND FUZZY LOGIC: THEORY AND APPLICATIONS, Prentice Hall, 1995.

Reference Books:

1. George J Klir and Tina A Folger, Fuzzy sets, Uncertainty and Information, Prentice Hall of India, 1988.
2. H. J. Zimmerman, Fuzzy Set theory and its Applications, 4th Edition, Kluwer Academic Publishers, 2001.
3. Timothy J Ross, Fuzzy Logic with Engineering Applications, McGraw Hill International Editions, 1997.

BHM 605. D AUTOMATA THEORY

MODULE –I (25 Hours)

Grammars and Languages: Language basics, Regular expressions, Regular grammars, Context free grammars, context-sensitive grammars, unrestricted grammars, Chomsky hierarchy.

MODULE –II (20 Hours)

Automata: Finite automata, pushdown automata, Pumping Lemmas and Closure properties, Turing machines and recursively enumerable languages.

MODULE –III (25 Hours)

Computability: Computable functions, non-recursively enumerable languages, Undecidability, Rice's theorem, Post's correspondence problem, Undecidability of validity problem of First Order Logic.

MODULE –IV (20 Hours)

Complexity: Asymptotic order symbol, Space and Time complexity, Classes P and NP, NP-completeness, Cook-Levin tehorem, Other NP-complete problems.

Text Books:

1. K. Krithivasan and R.Rama, Introduction to Formal Languages, Automata and Computation, Pearson Education, 2009.

2. A. Singh, Elements of Computation Theory, Springer (In: Texts in Computer Science Series),2009.