SACRED HEART COLLEGE (AUTONOMOUS)

Department of Mathematics

BACHELOR OF SCIENCE [MATHEMATICS]

Course plan

Academic Year 2015 – 16

Semester 6

COURSE PLAN

REAL ANALYSIS

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COURSE OBJECTIVE

*To study elementary concepts of real analysis

* To equip the students for analysing a problem and solving it.

*To understand both algebraic and geometrical implications of the results in real analysis.

TEXT BOOK

*S.C.MALIK SAVITHA ARORA … MATHEMATICAL ANALYSIS , SECOND EDITION

Sessions	Topic	Method	Remarks/Reference
1	Introductory Session		
2	A necessary condition for convergence	Lecture,Group Discussion, Problem Solving	
3	Cauchy`s general principle of convergence for a series.	Lecture,Group Discussion, Problem Solving	
4	Positive term series.	Lecture,Group Discussion, Problem Solving	
5	A necessary condition for convergence of positive term series.	Lecture,Group Discussion, Problem Solving	
6	Geometric series.	Lecture,Group Discussion, Problem Solving	
7	The comparison series$\sum 1/n^p$ Comparison test for positive term series without proof.	Lecture,Group Discussion, Problem Solving	
8	Cauchy`s root test	Lecture,Group Discussion, Problem Solving	
9	DALEMBERTE'S Ratio test	Lecture,Group Discussion, Problem Solving	
10	Raabe's test.	Lecture,Group Discussion, Problem Solving	
11	Gauss`s test.	Lecture,Group Discussion, Problem Solving	

12	Series with arbitrary terms. Alternating series.	Lecture,Group Discussion, Problem Solving	
13	Absolute convergence	Lecture,Group Discussion, Problem Solving	
14	Solving Exercise Problems		
15	Test paper 1		
16	Introduction to continuous function	Lecture, Group Discussion	
17	Continuity at a point	Lecture, Group Discussion	
18	Continuity in an interval	Lecture,Group Discussion, Problem Solving	
19	Discontinuous functions	Lecture,Group Discussion, Problem Solving	
20	Theorems on continuity	Lecture	
21	More Theorems	Lecture	
22	Theorems on continuity	Lecture	
23	Functions continuous on closed intervals	Lecture,Group Discussion, Problem Solving	
24	Functions continuous on closed intervals	Lecture,Group Discussion, Problem Solving	
25	Functions continuous on closed intervals	Lecture,Group Discussion, Problem Solving	
26	Uniform continuity	Lecture,Group Discussion, Problem Solving	
27	Uniform continuity	Lecture,Group Discussion, Problem Solving	
28	Doubt Clearing		
29	Revision on module 2		
30	Test Paper 2		
31	Introduction of module 3	Lecture and Group Discussion	

32	Definiton and existence of the integral	Lecture,Group Discussion, Problem Solving	
33	Definiton and existence of the integral	Lecture,Group Discussion, Problem Solving	
34	Inequalities of integrals	Lecture,Group Discussion, Problem Solving	
35	Refinement of partitions of integrability	Lecture,Group Discussion, Problem Solving	
36	Darboux's theorem	Lecture	
37	Condition of integrability	Lecture	
38	Integrability of the sum of integrable functions	Lecture, Problem Solving	
39	Integrability of the sum of integrable functions	Lecture, Problem Solving	
40	Integrability of the sum of integrable functions	Lecture,Problem Solving	
41	Integrability of the sum of integrable functions	Lecture, Problem Solving	
42	Integrability of the sum of integrable functions	Lecture,Problem Solving	
43	Group Discussion and doubt clearing		
44	The integrals as the limit of a sum	Lecture,Group Discussion, Problem Solving	
45	The integrals as the limit of a sum	Lecture,Group Discussion, Problem Solving	
46	Some applications	Lecture,Group Discussion, Problem Solving	
47	Some integrable functions	Lecture,Group Discussion, Problem Solving	
48	Some integrable functions	Lecture,Group Discussion, Problem Solving	
49	Integration and Differentiation	Lecture,Group Discussion, Problem Solving	
50	The fundamental theorem of calculus	Lecture,Group Discussion, Problem Solving	
52	Revision of module 3		

52	Test Paper 3		
53	Introduction to module 4		
54	Point wise convergence.	Lecture, Group Discussion	
55	Examples for Point wise convergence	Group Discussion	
56	Uniform convergence on an interval	Lecture,Group Discussion,Problem Solving	
57	Uniform convergence on an interval	Problem Solving	
58	Cauchy`s criterion for uniform convergence	Lecture,Group Discussion,Problem Solving	
59	Solved examples		
60	Examples	Group Discussion	
61	A test for uniform convergence of sequences	Lecture,Group Discussion, Problem Solving	
62	A test for uniform convergence of sequences	Lecture, Group Discussion	
63	Problems on test for Uniform convergence of sequences	Group Discussion	
64	Test for uniform convergence of series	Lecture, Group Discussion	
65	Test for uniform convergence of series	Lecture, Group Discussion	
66	Problems on test for Uniform convergence of series	Group Discussion	
67	Weierstrass M test	Lecture, Group Discussion	
68	Examples	Lecture,Group Discussion, Problem Solving	
69	Abel`s test	Lecture,Group Discussion, Problem Solving	
70	Examples	Lecture,Group Discussion, Problem Solving	
71	Statement of Dirichelet`s test without proof.	Lecture,Group Discussion, Problem Solving	
72	Solving Problems		
73	Doubt Clearing		
74	Revision	Lecture, Group Discussion, Problem Solving	
75	Test Paper 4		

Course Plan

Complex Analysis

Course Objectives:

The objectives of the course include familiarising the student with the theory of functions of one complex variable, differentiability and analyticity of such functions, complex integration and related topics

Day	Topic	Method
	MODULE I BEGINS	
1	Functions of a complex variable	Lecture
2	Selected Exercises on Pages 37-38	Seminar
3	Limits	Lecture
4	Theorems on Limits	Lecture
5	Continuity	Lecture
6	Selected Exercises on Pages 55-56	Seminar
7	Derivatives	Lecture
8	Differentiation Formulas	Lecture
9	Selected Exercises on Pages 62-63	Seminar
10	Cauchy- Riemann Equations	Lecture
11	Cauchy- Riemann Equations (Continued)	Lecture
12	Sufficient Conditions for Differentiability	Lecture
13	Selected exercises on Pages 71,72 and 73	Assignment
14	Analytic Functions	Lecture
15	Examples of Analytic FunctionsLecture	Lecture
16	Selected Exercises on Pages 77-78	Exercise
17	Harmonic Functions	Lecture
18	Harmonic Functions (Continued)	Lecture
19	Selected Exercises on pages 81-82	Seminar
20	The Exponential Function	Lecture
21	Selected Exercises on pages 92-93	Seminar
22	The Logarithm Function	Lecture
23	Selected Exercises on pages 97- 98	Seminar

24	Complex Exponents	Lecture
25	Complex Exponents (Continued)	Lecture
26	Selected Exercises on Page 104	Seminar
27	Trigonometric Functions	Lecture
28	Selected Exercises on Pages 108-109	Seminar
29	Hyperbolic Functions	Lecture
30	Selected Exercises on Pages 111-112	Seminar
31	Inverse Trigonometric and Hyperbolic Functions	Lecture
32	Selected Exercises on Pages 114-115	Seminar
33	**FIRST CIA**	
	(MODULE II BEGINS)	
34	Derivatives of Functions	Lecture
35	Definite Integrals of Functions	Lecture
36	Selected Exercises on Pages 121	Assignment
37	Contours	Lecture
38	Contours (Continued)	Lecture
39	Selected Exercises on pages 125- 126	Seminar
40	Contour Integrals	Lecture
41	Some Examples of Contour Integrals	Lecture
42	Upper Bounds for Moduli of Contour integrals	Lecture
43	Examples and Selected Exercises on pages 141	Seminar
44	Antiderivatives	Lecture
45	Cauchy Goursat Theorem	Lecture
46	Simply Connected Domains	Lecture
48	Multiply Connected Domains	Lecture
49	Selected Exercises on Pages 160,161 & 162	Assignment
50	Cauchy's Integral Formula	Lecture
51	An extension of Cauchy's Integral Formula	Lecture
52	Some Consequences of the Extension	Lecture
53	Selected Exercises on pages 171-172	Seminar
54	Liouville's Theorem and the Fundamental theorem of Algebra	Lecture
55	Maximum Modulus Principle	Lecture

	(MODULE III BEGINS)	
56	Convergence of Sequences	Lecture
56	Convergence of Series	Lecture
57	Convergence of Series (Continued)	Lecture
58	Selected Exercises on Pages 188-189	Assignment
59	Taylor Series	Lecture
60	Proof of Taylor's theorem	Lecture
61	Examples of Taylor's series	Lecture
62	Selected Exercises on pages 196-197	Seminar
63	Laurent Series	Lecture
64	Examples of Laurent Series	Lecture
65	Selected Exercises on pages 205-207	Assignment
66	SECOND CIA	Lecture
	MODULE IV BEGINS	Lecture
67	Isolated Singular Points	Lecture
68	Residues	Lecture
69	Examples	Lecture
70	Cauchy's Residue Theorem	Lecture
71	Selected Exercises on pages 239-240	Seminar
72	The three types of isolated singular points	Lecture
73	Examples	Lecture
74	Selected Exercises on pages 243-244	Assignment
75	Residues at Poles	Lecture
76	Examples	Lecture
77	Selected Exercises on pages 248-249	Seminar
78	Evaluation of improper integrals	Lecture
79	Evaluation of improper integrals (Continued)	Lecture
80	Examples	Lecture
81	Selected Exercises on pages 267-268	Seminar
82	Improper integrals from Fourier Analysis	Lecture
83	Improper integrals from Fourier Analysis (Continued)	Lecture
84	Jordan's Lemma	Lecture

85	Selected Exercises on Pages 275-276	Seminar
86	Definite Integrals involving Sines and Cosines	Lecture
87	Selected Exercises on Pages 290-291	Assignment
88	REVISION	Lecture
89	REVISION	Lecture
90	REVISION	Lecture

COURSE PLAN

DISCRETE MATHEMATICS

Course Objectives: * To introduce graph theory and its applications
To understand cryptography
*To study lattices.

Sessions	Topic	Remarks/Reference
1	Introduction to Graph	
2	History	
3	Definition and examples	
4	Graph as models	
5	More Definitions	
6	Examples	
7	Vertex degree	
8	Examples and problems	
9	Sub Graphs	
10	Problems	
11	Seminar	
12	Seminar	
13	Paths and cycles	
14	Matrix representation	
15	Problems	
16	Seminar	
17	Seminar	
18	Trees.	
19	connectivity.	
20	Connectivity Problems	
21	Connectivity Problems	
22	Properties of connected graphs	
23	Properties of connected graphs	
24	Bridges.	
25	Bridges	
26	Spanning trees	
27	Cut vertices	
28	Cut vertices problems	
29	Cut vertices problems	
30	Revision	
31	Problems	
32	Class test	
33	Euler Tour	
34	Problems	
35	Problems	
36	Hamiltonian Cycle	
37	Problems	

38	Euler's tour	
39	Chinese postman problem	
40	Hamiltonian Graphs	
41	Examples and problems	
42	Examples and problems	
43	Examples and problems	
44	Matching	
45	Matching	
46	Matching	
47	Hall's marriage problem	
48	Personal assignment problem	
49	Optimal assignment Prroblem	
50	Problems	
51	Revision	
52	Introduction	
53	Caesar Cipher	
54	Problems	
55	Problems	
56	Hill's Ciper	
57	Problems	
58	Problems	
59	Public key Cryptography	
60	Public key Cryptography	
61	RSA Cryptosystem	
62	Problems	
63	Problems	
64	the Knapsack problem	
65	the Knapsack problem	
66	test	
67	Introduction	
68	Diagramatical Representation of a Poset, Diagramatical Representation of a Poset,	
69	Isomorphisms	
70	Isomorphisms	
71	Duality	
72	Duality	
73	Product of two Posets	
74	Lattices	
75	Lattices	
76	Semilattices,	
77	Complete Lattices,	
78	Sublattices	
79	Revision	
80	Revision	

COURSE PLAN

LINEAR ALGEBRA AND METRIC SPACES

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Course Objectives: * To introduce vector spaces ,basis and linear transformation.
To understand linear dependence and independence
*To study metric spaces and its properties.

TEXT BOOK

* Richard Bronson,Gabriel B Costa – Linear Algebra An Introduction(Second Edition)
* G.F.Simmons – Introduction to topology and modern analysis(Tata Mc Graw Hill)

Sessions	Topic	Method
1	Introductory Session	Interactive session
2	Definition of vector space	Lecture and interaction
3	Examples	Group discussion and problem solving
4	Solving exercise 2.1	
5	Theorems	Lecture
6	Subspaces-Definition	Lecture,Group Discussion
7	Examples	Group discussion and problem solving
8	Solving exercise 2.2	
9	Theorems	Lecture
10	Linear dependence and independence	Lecture,Group Discussion
11	Problems	Group discussion and problem solving
12	Theorems	Lecture
13	Basis	Lecture
14	Examples	Group discussion and problem solving
15	Theorems	Lecture
16	Theorems	Lecture
17	Dimension of Vector space	Lecture
18	Coordinate representation	Lecture
19	Problems	Group discussion and problem solving
20	Row space of a matrix	Lecture

21	Examples and theorems	Lecture
22	Theorems	Lecture
23	Revision of module 1	
24	Test paper 1	
25	Introduction to module 2	Interaction session
26	Functions	Interaction session
27	Linear Transformation	Lecture,Group Discussion
28	Examples	Group discussion and problem solving
29	Solving exercise 3.2	Group discussion and problem solving
30	Matrix representations	Lecture
31	Problems	Group discussion and problem solving
32	Exercise problem	
33	Change of basis	Lecture,Group Discussion
34	Theorems	Lecture
35	Problems	Group discussion and problem solving
36	Theorems	Lecture
37	Properties of linear transformation	Lecture
38	Kernel of a matrix	Lecture
39	Problems	Group discussion and problem solving
40	Image of a linear transformation	Lecture
41	Problems	Group discussion and problem solving
42	Theorems	Lecture
43	Rank-Nullity Theorem	Lecture
44	Theorems	Lecture
45	One–one and onto linear transformation	Lecture,Group Discussion
46	Problems	, Group discussion and problem solving
47	Exercise problems 3.5	
48	Revision of module 2	

49	Test Paper 2	
50	Introduction to module 3	Interaction session
52	Metric-Definition	Lecture,Group Discussion
52	Examples	Lecture,Group Discussion
53	Metric Space-Definition	Lecture,Group Discussion
54	Examples	Lecture,Group Discussion
55	More examples on metric spaces	Lecture,Group Discussion
56	Open set-Definition	Lecture,Group Discussion
57	Examples	Lecture,Group Discussion
58	Theorems	Lecture
59	Theorems	Lecture
60	Theorems	Lecture
61	Theorems	Lecture
62	Interior of a set and its properties	Lecture, Group Discussion
63	Closed set-Definition	Lecture and interaction
64	Examples	Lecture,Group Discussion
65	Theorems	Lecture
66	Theorems	Lecture
67	Cantor set	Lecture
68	Properties of cantor set	Lecture,Group Discussion
69	Boundary of a set and its properties	Lecture
70	Revision	
71	Test Paper 3	
72	Introduction to module 4	Interaction session

73	Convergence of a sequence	Lecture
74	Examples	Group discussion and problem solving
75	Theorems	Lecture
76	Cantor’s Intersection Theorem	Lecture
77	Theorems	Lecture
78	Complete metric space	Lecture
79	Continuous mapping	Lecture
80	Theorems	Lecture
81	Theorems	Lecture
82	Theorems	Lecture
83	Theorems	Lecture
84	Revision	
85	Test Paper 4	

Course Plan

Operations Research

COURSE OBJECTIVES

The course aims

- To introduce and explain the ideas relevant to Mathematical programming in detail;
- To explain methods to solve Linear Programming Problem

Basic Reference

1. Optimization methods in Operations Research and System Analysis - K.V.Mital and C.Mohan
2. Operations Research – J.K.Sharma

Sessions	Topic	Method
1	Mathematical Preliminaries - Introduction	Lecturing
2	Euclidean space	Lecturing
3	Convex sets	Lecturing
4	Convex sets	Lecturing
5	Convex sets	Lecturing
6	Introduction to LPP	Lecturing
7	LP in 2 dimensional space	Lecturing
8	Optimal solution	Lecturing
9	Simple Problems	Lecturing
10	Problems	Group work
11	Simplex method	Lecturing
12	Problems	Group work

13	Problems	Group work
14	2 Phase simplex method	Lecturing
15	Big M method	Lecturing
16	Problems	Lecturing
17	Problems	Group work
18	Problems	Lecturing
19	Duality in LPP	Lecturing
20	Problems	Group work
21	CIA – I (Module -1)	
22	Problems	Lecturing
23	Dual simplex method	Lecturing
24	Applications	Lecturing
25	Problems	Group work
26	Problems	Lecturing
27	Introduction Transportation Problem	Lecturing
28	Problems	Lecturing
29	Finding basic feasible solution	Lecturing
30	Testing of optimality	Lecturing
31	Loop in transportation	Lecturing
32	degeneracy	Lecturing
	Problems	Lecturing
33	Unbalance Problem	Lecturing
34	Problems	Lecturing
35	Assignment Problems	Lecturing
36	Problems	Lecturing
37	Queueing theory introduction	Lecturing
38	Essential features of queuing system	Lecturing
39	Calling Population	Lecturing

40	Characteristics queuing process	Lecturing
41	Queue discipline	Lecturing
42	Service Process	Lecturing
43	Perfomance measure of system	Lecturing
44	Transient state , steady state	Lecturing
45	Relation amoung performance measure	Lecturing
46	Probability distribution in queuing system	Lecturing
47	Problems	Lecturing
48	Problems	Lecturing
49	Problems	Lecturing
50	Problems	Lecturing
51	Distribution of arrival	Lecturing
52	Distribution of interarrival times	Lecturing
53	Distribution of departure	Lecturing
54	Distribution of service time	Lecturing
55	Convex hull	Lecturing
56	Vertices of a convex set	Lecturing
57	Convex polyhedron	Lecturing
58	Hyperplanes , half space and polytopes	Lecturing
59	Separating and supporting hyperplanes	Lecturing
60	Numerical examples	Lecturing
61	CIA II	2 HOURS
62 -72	Revision	