SACRED HEART COLLEGE (AUTONOMOUS)

Department of Mathematics

M.Sc. Mathematics

Course plan

Academic Year 2015 – 16

Semester 2

COURSE PLAN

P2MATT06 - ABSTRACT ALGEBRA

COURSE OBJECTIVES

This is an advanced course in algebra. It aims at enlightening the students with topics in group theory starting with direct products and culminating with the applications of sylow theorems. It also deals with field theory culminating with the main theorem of Galois theory.

Text Book

1.A First Course in Abstract Algebra by John B Fraleigh 3rd Edition

Additional references

1) Contemporary Abstract Algebra by Joseph Gallian

2) Topics in Algebra by I.N.Herstein

3) Algebra by Michael Artin

4) Abstract Algebra by David S Dummit and Richard M Foote.

Proofs of theorems to be avoided in bridge course. Only concept and examples required

Sessions	Topic	Method
1	Bridge Course: Chapter 1 of text	Group Discussion followed by a Lecture session.
2	Bridge Course : Chapter 2 of text excluding direct products	Interactive session including GD
3	Bridge Course: chapter 4 of text.	Lecture session with Examples
4	Bridge Course: Chapter 5 of text.	Lecture session with Examples
5	Bridge Course: Section 27.1-27.20	Lecture session
5	Bridge Course: Section 27.1-27.20	Lecture session
6 MODULE I BEGINS	Definition 11.1, Theorem 11.2 and example 11.3	Lecture session
7	Example 11.4, Theorem 11.5, Corollary 11.6 and example 11.7	Interactive session and Lecture
8	Definition 11.8, Theorem 11.9, Example 11.10, Example 11.11	Lecture
9	Theorem 11.12, Example 11.13, Definition 11.14, Theorem 11.15	Lecture
10	Theorem 11.16, Theorem 11.17 and selected exercises of Exercise 11	Lecture
11	Exercise 11 continued	Lecture
12	Definition 16.1, Example 16.2, Theorem 16.3	Interactive session
13	Examples 16.4- 16.8	Assignment and seminar for the students.
14	Example 16.11, Theorem 16.12, Definition 16.13 and Theorem 16.14	Lecture
15	Definition 16.15 and theorem 16.16 and example 16.17	Lecture
16	Theorem 36.1, Definition 36.2	Lecture
17	Theorem 36.3 and Corollary 36.4	**Lecture**
18	Definition 36.5, Lemma 36.6 and Corollary 36.7	Lecture
19	The three Sylow Theorems (Statements only) Example 36.12 and Example 36.13	Lecture
20	Theorem 37.1 and definition 37.2 and example 37.3	Lecture
21	Theorem 37.4, Lemma 37.5 and Theorem 37.6	Lecture

22	Theorem 37.7 and Lemma 37.8	Lecture
23	Example 37.9- Example 37.12	Lecture
24	Example 37.13-Example 37.15	Lecture
25	Examples continued and selected exercises of Exercise 37	Lecture
26	**FIRST CIA**	Written Test; Descriptive.
27 **MODULE 2 BEGINS**	Definition 22.1 and Theorem 22.2	Lecture
28	Example 22.3, R[x,y], and theorem 22.4	Lecture
29	Examples 22.6-22.10	Lecture
30	Theorem 22.11	Seminar
31	Selected Exercises of Exercise 22	Seminar
32	Selected Exercises of Exercise 22	Seminar
33	Theorem 23.1	
34	Example 23.2 and Corollary 23.3	Lecture
35	Example 23.4 and corollary 23.5	Lecture
36	Corollary 23.6, Definition 23.7 and Example 23.8	Lecture
37	Example 23.9, Theorem 23.10, Theorem 23.11 and Corollary 23.12	Lecture
38	Example 23.13,23.14 and a similar problem in exercises	Lecture
39	Theorem 23.15 and example 23.16	**Lecture**
40	Corollary 23.17	Lecture
41	Definition 27.21, Example 27.22,27.23 and Theorem 27.24	Lecture
42	Theorem 27.25 and example 27.26	Lecture
43	Example 27.26 and theorem 27.27 and selected exercises of exercise 27	Lecture
44	Theorem 23.18, Corollary 23.19 and theorem 23.20	**Lecture**
45	Example 23.21 and selected exercises of Exercise 23	Seminar

46	Example 23.21 and selected exercises of Exercise 23	Seminar
47	Definition 29.1 and Theorem 29.3	Lecture
48	Example 29.4, 29.5, Definition 29.6,Examples 29.7-29.10.	Lecture
49	Definition 29.11 and theorem 29.12, Theorem 29.13	Lecture
50	Definition 29.14, Example 29.15, Simple Extensions	Lecture
51	Example 29.16, Definition 29.17 and Theorem 29.18	
52	Example 29.19 and selected exercises of Exercise 29	Lecture
53	selected exercises of Exercise 29	Seminar
54	Theorem 30.23, Definition 31.1,31.2	Lecture
55	Theorem 31.3,31.4	Lecture
56	Corollary 31.6,31.7, Examp;e 31.8,31.9	Lecture
57	Example 31.10, Theorem 31.11	Lecture
58	Theorem 31.12, Corollary 31.13, Definition 31.14 and Theorem 31.15	Lecture
59	Corollary 31.16, Theorem 31.17 and theorem 31.18	Lecture
60	Selected exercises of Exercise 31	
61MODULE III BEGINS	Theorem 32.1 and Corollary 32.5	Seminar
62	Theorem 32.6	Lecture
63	Corollary 32.8, Theorems 32.9- 32.11	Seminars
64	Theorem 33.1, Corollary 33.2, Theorem 33.3	Lecture
65	Definition 33.4, Theorem 33.5, Corollary 33.6 and Example 33.7	Lecture
66	Lemma 33.8 and Lemma 33.9	Lecture
67	Theorem 33.10, Corollary 33.11 and Theorem 33.12	
68	Definition 48.1, Example 48.2, Theorem 48.3	Lecture
69	Corollary 48.5, Corollary 48.6 and Example 48.7	Lecture

70	Definition 48.8, Example 48.9, 48.10, 48.11 and Definition 48.12	Lecture
71	Example 48.13, Theorem 48.14, Theorem 48.15, Definition 48.16, Example 48.17	
72	Theorem 48.19, Selected Exercises of Exercise 48	
73	Theorem 49.3**(** Statement only) and Corollary 49.5	
74	SECOND CIA	
75 MODULE IV BEGINS	Definition 50.1, Example 50.2, Theorem 50.3	Lecture
76	Definition 50.4, Example 50.5, Corollary 50.6, 50.7	Lecture
77	Example 50.8 and 50.9. Selected Exercises of Exercise 50.	Lecture
78	Definition 51.1, Theorem 51.2, Corollary 51.3.	Lecture
79	Example 51.4, Theorem 51.6, Definition 51.7 and Example 51.8	Lecture
80	Theorem 51.9 and Corollary 51.10	LECTURE
81	Lemma 51.11, Definition 51.12 and Theorem 51.13	LECTURE
82	Theorem 51.14	LECTURE
83	Theorem 51.15	LECTURE
84	Definition 53.1, Theorem 53.2	LECTURE
85	Example 53.3, Definition 53.5	LECTURE
86	Theorem 53.6	LECTURE
87	Theorem 53.6 (Continued)	LECTURE
88	Theorem 53.7 and Example 53.8	LECTURE
89	REVISION	
90	REVISION	

COURSE PLAN
P2MATT07 - ADVANCED TOPOLOGY

COURSE OBJECTIVES

To introduce Topological space and study the advanced properties associated with the space. To introduce the concept of Embedding, metrisation and compactification.

Text Book: K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd,1984.

Sessions	Topic	Method	Remarks/Reference
1.	Introductory Session – separation axioms	Lecture	
2.	Urysohn characterisation of normality	Lecture	
3.	Definition and proposition	Lecture	
4.	Urysohn's Lemma	Lecture,	
5.	Theorem and Lemma	Lecture,	
6.	Theorems and Lemma	Lecture,	
7.	Tietz characterisation of normality: proposition	Lecture,	
8.	Proposition	Lecture,	
9.	Definition and proposition	Lecture,	
10.	Proposition	Lecture	
11.	Theorem and proposition	Lecture,	
12.	Products and co products – Cartesian products of family of sets: Basic definitions	Lecture	
13.	Proposition	Lecture,	
14.	Proposition	Lecture,	
15.	Theorem	Lecture,	
16.	Theorem	Lecture,	
17.	Definition and Theorem	Lecture,	
18.	Product topology – Basic definitions	Lecture, Group Discussion, Problem Solving	

19.	Theorems	Lecture,	
20.	Theorems and propositions	Lecture,	
21.	Propositions and definitions	Lecture,	
22.	Productive properties - Basic definitions	Lecture,	
23.	Theorems and Lemma	Lecture,	
24.	Theorems and Lemma	Lecture,	
25.	Theorems and Lemma	Lecture,	
26.	Theorems and Lemma	Lecture,	
27.	Theorems and Lemma	Lecture,	
28.	Module 2 – Embedding and metrisation	Lecture,	
29.	Definitions	Lecture, Group Discussion, Problem Solving	
30.	Theorems and Propositions on evaluation function	Lecture,	
31.	Theorems and Propositions on evaluation function	Lecture,	
32.	Theorems and Propositions on evaluation function	Lecture,	
33.	Embedding Lemma and Tychonoff embedding – Basic Definitions	Problem Solving	
34.	Theorem	Lecture,	
35.	Theorem	Lecture,	
36.	Lemma	Lecture,	
37.	Proposition	Lecture,	
38.	Urysohn metrisation Theorem - Basic Definitions and theorem	Lecture,	
39.	Corollary and problems	Lecture, Group Discussion, Problem Solving	
40.	Module 3 – Nets and filters introduction, Basic definition	Lecture,	
41.	Theorems and proposition	Lecture,	

42.	Theorems and proposition	Lecture,	
43.	Topology and convergence of nets – Basic definitions	Lecture,	
44.	Theorems and corollaries	Lecture,	
45.	Theorems and corollaries	Lecture,	
46.	Theorems and Propositions	Lecture,	
47.	Theorems and propositions	Lecture,	
48.	Filters and their convergence – Basic definitions	Lecture,	
49.	Theorems and corollaries	Lecture,	
50.	Theorems and Propositions	Lecture,	
51.	Theorems and Propositions	Lecture,	
52.	Ultrafilter and compactness	Lecture,	
53.	Ultrafilter and compactness	Lecture,	
54.	Theorems and propositions	Lecture,	
55.	Problems	Lecture,	
56.	Module 4 - Introduction	Lecture	
57.	Variation of compactness - Basic definitions	Lecture,	
58.	Theorems, corollaries and propositions	Lecture,	
59.	Theorems, corollaries and propositions	Lecture,	
60.	Theorems, corollaries and propositions	Lecture,	
61.	Theorems, corollaries and propositions	Lecture,	
62.	Theorems, corollaries and propositions	Lecture,	
63.	Local compactness - Definitions	Lecture,	
64.	Propositions and corollaries	Lecture,	
65.	Propositions and corollaries	Lecture,	
66.	Propositions and corollaries	Lecture,	

67.	Compactification- Basic definitions	Lecture,	
68.	Theorems and proposition	Lecture,	
69.	Propositions and corollaries	Lecture,	
70.	Theorems	Lecture,	
71.	Theorems	Lecture,	
72.	Propositions	Lecture,	
73.	Propositions	Lecture,	
74.	Problems	Group discussion	
75.	Problems	Group discussion	
76.	Problems	Group discussion	
77.	Problems	Group discussion	
78.	Problems	Group discussion	

References:

1. Munkers J.R, Topology – A first course, Prentice Hall of India Pvt.Ltd., New Delhi,2000.
2. J.L.Kelly, General Topology.Van Nostrand, Reinhold Co.,NewYork,1995.
3. Stephen Willard , General Topology,Addison – Wesley.
4. Dugundji, Topology, Universal Book Stall, New Delhi.
5. George F Simmons, introduction to Topology and Modern Analysis, Mc Graw-Hill Book Company,1963.

COURSE PLAN
P2MATT08 - Advanced Complex Analysis

Course Prerequisites:
Calculus, Analysis

Guidelines/Suggestions for Teaching Methods and Student Learning Activities:
This course is taught as a lecture course with student participation and use of computers

Course Objectives:
To develop in a rigorous and self contained manner the elements of complex variables and to furnish an introduction to applications and residues and conformal mappings

Basic Reference
1.AHLFORS V. LARS, COMPLEX ANALYSIS,McGRAW-HILL INTERNATIONAL EDITIONS, 3RD EDITION

HOURS	TOPIC
1	INTRODUCTION
2	ELEMENTARY THEORY OF POWER SERIES
3	SEQUENCE AND SERIES
4	UNIFORM CONVERGANCE
5	POWER SERIES
6	ABEL'S LIMIT THEOREM
7	POWER SERIES EXPNSION
8	WEISTRASS THEOREM
9	TAYLOR'S THEOREM
10	LAURENT'S THEOREM
11	PARTIAL FRACTIONS
12	INFINITE PRODUCTS
13	CANNONICAL PRODUCTS
14	GAMMA FUNCTION
15	GAMMA FUNCTION
16	SEMINAR
17	SEMINAR
18	SEMINAR
19	SEMINAR
20	SEMINAR
21	JENSON'S FORMULA
22	HADAMARD'S THEOREM
23	THE REIMANN ZETAFUNCTION
24	EXTENSION TO THE ENTIRE PLANE
25	FUNCTIONLA EQUATION
26	THE ZEROS OF ZETA FUNCTION
27	THE ZEROS OF ZETA FUNCTION
28	THE ZEROS OF ZETA FUNCTION
29	ARZELA'S THEOREM
30	ARZELA'S THEOREM

31	SEMINAR
32	SEMINAR
33	SEMINAR
34	SEMINAR
35	SEMINAR
36	SEMINAR
37	SEMINAR
38	SEMINAR
39	SEMINAR
40	THEREIMANN MAPPING THEOREM
41	THEREIMANN MAPPING THEOREM
42	THEREIMANN MAPPING THEOREM
43	BOUNDARY BEHAVIOUR
44	USE OF REFLECTION PRINCIPLE
45	ANALYTIC ARCS
46	CONFORMAL MAPPING OF POLYGONS
47	SCHWARZ CHRISTOFFEL FORMULA
48	MEAN VALUE PROPERTY
49	MEAN VALUE PROPERTY
50	HARNACK'S PRINCIPLE
51	HARNACK'S PRINCIPLE
52	HARNACK'S PRINCIPLE
53	SUBHARMONIC FUNCTIONS
54	SUBHARMONIC FUNCTIONS
55	SEMINAR
56	SEMINAR
57	SEMINAR
58	SEMINAR
59	SEMINAR
60	SEMINAR
61	SIMPLY PERIODIC FUNCTIONS
62	DOUBLY PERIODIC FUNCTIONS
63	THE FOURIER DEVELOPMENT
64	THE PERIOD MODULE
65	UNIMODULAR TRANSFORMATIONS
66	CANNONICAL BASIS
67	WEISTRASS FUNCTION
68	WEISTRASS FUNCTION
69	WEISTRASS FUNCTION
70	WEISTRASS FUNCTION
71	SEMINAR
72	SEMINAR
73	SEMINAR
74	SEMINAR
75	SEMINAR
76	SEMINAR

COURSE PLAN
P2MATT09 , FUNCTIONAL ANALYSIS

Sl.No	No. of Sessions/hrs	Topics to be taught	Method of teaching
1	1	Fundamentals of Linear Algebra and Metric spaces.	Lecture , Seminar , Assignment
2.	3	Normed space and Banach space , examples and their properties , problems.	Lecture , assignment
3	2	Finite dimensional normed spaces and their sub spaces , problems.	Lecture
4	2	Compactness and finite dimension , problems.	Lecture
5	2	Linear operators, examples and their properties, problems.	Lecture, assignment
6		**Test paper.**	
7	2	Bounded and continuous linear operators and examples.	Lecture
8	2	Problems based on bounded linear operators.	Lecture
9	1	Linear functionals , examples.	Lecture
10		**First internal**	
11	2	Bounded linear Functionals and their properties, problems.	Lecture
12	2	Linear Operators and Functionals on a finite dimensional normed space , problems.	Lecture , assignment
13	2	Normed space of Operators and Functionals.	Lecture , assignment
14	2	Examples of dual spaces.	Lecture
15		**Test paper on module 2**	
16	2	Inner product spaces and Hilbert spaces , examples , problems.	Lecture
17	2	Further properties of inner product spaces.	Lecture , seminar
18	2	Orthogonal complement and direct sum , problems.	Lecture
19	2	Orthogonal sets and sequences.	seminar
20	2	Bessel inequality, Gram- Schmidt process for ortho normalisation.	Lecture, seminar
21	2	Total ortho normal sets and sequences , problems.	Lecture , seminar, assignment
22	2	Rieszs theorem .	seminar
23	2	Sesqui linear functional and Riesz representation theorem.	Lecture , seminar

24	3	Problems based on Riesz theorem and Riesz representation theorem.	Lecture
25	2	Hilbert adjoint and its properties.	Lecture , seminar
2	3	Problems based on Hilbert adjoint operators.	Lecture , assignment , seminar
27	2	Self adjoint , normal and unitary operators, problems.	Lecture , assignment
28		**Test paper on module 3.**	
29	2	Zorns Lemma and its applications.	Lecture
30	2	Hahn Banach theorem for real vector space.	Lecture
31	2	Generalised Hahn Banach theorem, problems.	Lecture , assignment
32	1	Hahn Banach theorem for a normed space.	Lecture
33	3	Problems on Hahn Banach theorems	Lecture, seminar
34	1	Adjoint operator, relation between adjoint operator and Hilbert adjoint.	Lecture
35	2	Reflexive spaces, canonical mapping.	Lecture,seminar
36	2	Important theorems and problems.	Lecture
37	2	Bairs category theorem, Uniform boundedness theorem.	Lecture , seminar assignment
38	1	Problems on Uniform boundedness theorem	Lecture , assignment
39		**Model examination**	

COURSE PLAN
COURSE: P2MATT10: REAL ANALYSIS

COURSE OBJECTIVES

To understand functions of bounded variation, Riemann integrals, Riemann Stieltjes integral, uniform convergence and trigonometric and exponential functions.

Text Book

1. Tom Apostol, Mathematical Analysis (second edition), Narosa Publishing House.
2. Walter Rudin, Principles of Mathematical Analysis (Third edition), International Student Edition.

No of Hours	Topic	Method	Remarks/Reference
5	A quick review on continuity, uniform continuity, convergence of sequence and series.	Lecture, Group Discussion, Problem SolvingLecture	Module-1 (15+5 Hours)
2	Introductionproperties of monotonic functions	Lecture, Group Discussion, Problem Solving	
2	functions of bounded variation	Lecture, Group Discussion, Problem Solving	
2	total variation		
2	additive property of total variation	Lecture, Group Discussion, Problem Solving	
2	total variation on (a, x) as a functions of x	Lecture, Group Discussion, Problem Solving	
2	functions of bounded variation expressed as the difference of increasing functions	Lecture, Group Discussion, Problem Solving	
2	continuous functions of bounded variation	Lecture, Group Discussion, Problem Solving	
2	curves and paths	Lecture, Group Discussion, Problem Solving	
2	rectifiable path and arc length	Lecture, Group Discussion, Problem Solving	
1	additive and continuity properties of arc length	Lecture, Group Discussion, Problem Solving	
1	equivalence of paths	Lecture, Group Discussion, Problem Solving	
5	Definition and existence of the integral	Lecture, Group Discussion, Problem Solving	Module-II (15 Hours)

5	properties of the integral	Lecture, Group Discussion, Problem Solving	
5	integrationand differentiation	Lecture, Group Discussion, Problem Solving	
5	integration of vector valued functions	Lecture, Group Discussion, Problem Solving	
2	Discussion of main problem	Lecture, Group Discussion, Problem Solving	Module-III (25 Hours)
6	uniform convergence	Lecture, Group Discussion, Problem Solving	
6	uniform convergence and continuity	Lecture, Group Discussion, Problem Solving	
6	uniform convergence and integration	Lecture, Group Discussion, Problem Solving	
4	uniform convergence and differentiation	Lecture, Group Discussion, Problem Solving	
1	the Stone-Weierstrass theorem (without proof)	Lecture, Group Discussion, Problem Solving	
1	Power series	Lecture, Group Discussion, Problem Solving	Module-IV (20 Hours)
3	the exponential and logarithmic functions	Lecture, Group Discussion, Problem Solving	
4	the trigonometric functions	Lecture, Group Discussion, Problem Solving	
4	the algebraic completeness of complex field	Lecture, Group Discussion, Problem Solving	
3	Fourier series.	Lecture, Group Discussion, Problem Solving	

1. Additional Reading List

1.Royden H.L, Real Analysis, 2nd edition, Macmillan, New York.
2. Bartle R.G, The Elements of Real Analysis, John Wiley and Sons.
3. S.C. Malik, Savitha Arora, Mathematical Analysis, New Age International Ltd.
4. Edwin Hewitt, Karl Stromberg, Real and Abstract Analysis, Springer International, 1978.