SACRED HEART COLLEGE (AUTONOMOUS)

Department of Mathematics

MSc Mathematics

Course Plan

2018 – 19

Semester III

COURSE PLAN

PROGRAMME	MASTER OF SCIENCE IN MATHEMATICS	SEMESTER	3
COURSE CODE AND TITLE	16P3MATT11- PARTIAL DIFFERENTIAL EQUATIONS	CREDIT	4
HOURS/WEEK	5	HOURS/SEM	72
FACULTY NAME	MARIA SEBASTIAN		

Course Objectives

- To Explain the basic theory simultaneous diff equation
- To Analyze the concept of Pffafian diff equation
- To Explain the formation and solution of first order partial differential equation.
- To Explain about the orthogonal trajectories and compatible system.
- To Apply different methods to find the solution of higher order pde.

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
MODULE I				
1	Introduction about the course	PPT		
2	Orgins of first order partial differential equation.	Problem solving		
3		Lecture		
4	Orgins of first order partial differential equation.	Problem solving		
5	Methods of solutions of dx/p = dy/Q = dz/R	Lecture		
6	Methods of solutions of dx/p = dy/Q = dz/R	Problem solving		
7	Methods of solutions of dx/p = dy/Q = dz/R	Lecture		
8	Methods of solutions of dx/p = dy/Q = dz/R	Lecture		
9	Orthogonal trajectories of a system of curves on a surface	Lecture		
10	Orthogonal trajectories of a system of curves on	Lecture/Problem		

	a surface	solving		
11	Pfaffian differential forms and equations	Lecture		
12	Solution of Pfaffian differential equations in three variables Partial differential equations	Lecture/Problem solving		
13	Solution of Pfaffian differential equations in three variables Partial differential equations	Lecture/Problem solving		
14	Linear equations of first order	Lecture		
15	Linear equations of first order	Lecture/Problem solving		
16	Linear equations of first order	Lecture		
17	Integral surfaces passing through a given curve	Lecture/Problem solving		
MODULE II				
18	Integral surfaces passing through a given curve	PPT/Lecture		
19	Surfaces orthogonal to a given system of surfaces	Lecture		
20	Surfaces orthogonal to a given system of surfaces			
21	Surfaces orthogonal to a given system of surfaces	Lecture		
22	Nonlinear partial differential equation of the first order	Lecture		
23	Nonlinear partial differential equation of the first order	Lecture/Problem solving		
24	Nonlinear partial differential equation of the first order	Lecture/Problem solving		
25	Nonlinear partial differential equation of the first order	Lecture/Problem solving		
26	Compatible systems of first order equations	Lecture/Problem solving		

27	Compatible systems of first order equations	Lecture/Problem solving		
28	Compatible systems of first order equations	Lecture/Problem solving		
29	Charpits Method	Lecture/Problem solving		
30	Charpits Method	Lecture/Problem solving		
	CIA-1			
31	Charpits Method	Lecture		
32	Charpits Method	Lecture/Problem solving		
33	Special types of first order equations	Lecture/Problem solving		
34	Special types of first order equations	Lecture/Problem solving		
35	Solutions satisfying given conditions	Lecture		
36	Solutions satisfying given conditions	Lecture/Problem solving		
MODULE III				
37	Jacobi's method	Lecture/Problem solving		
38	Jacobi's method	Lecture/Problem solving		
39	Jacobi's method	Lecture/Problem solving		
40	Test	Lecture/Problem solving		
41	The origin of second order equations.	Lecture/Problem		

		solving		
42	The origin of second order equations.	Lecture/Problem solving		
43	The origin of second order equations.	Lecture/Problem solving		
44	Linear partial differential equations withconstant coefficients	Lecture/Problem solving		
45	Linear partial differential equations with constant coefficients	Lecture/Problem solving		
46	Linear partial differential equations with constant coefficients	Lecture/Problem solving		
47	Equations with variable coefficients.	Lecture/Problem solving		
48	Equations with variable coefficients.	Lecture/Problem solving		
49	Equations with variable coefficients.	Lecture/Problem solving		
50	Characteristic curves of second order equations	Lecture/Problem solving		
51	Characteristic curves of second order equations	Lecture/Problem solving		
52	Characteristic curves of second order equations	Lecture/Problem solving		
53	Test	Lecture/Problem solving		
54	The solution of linear Hyperbolic equations	Lecture/Problem solving		
Module-IV				
55	The solution of linear Hyperbolic equations	Lecture/Problem solving		

56	Separation of variables	Lecture/Problem solving		
57	Separation of variables	Lecture/Problem solving		
58	Separation of variables	Lecture/Problem solving		
59	Separation of variables	Lecture/Problem solving		
60	Non linear equations of the second order	Lecture/Problem solving		
61	Non linear equations of the second order	Lecture/Problem solving		
62	Non linear equations of the second order	Lecture/Problem solving		
63	Elementary solutions of Laplace equation	Lecture/Problem solving		
64	Elementary solutions of Laplace equation	Lecture/Problem solving		
CIA - II				
65	problems	Lecture/Problem solving		
66	Elementary solutions of Laplace equation	Lecture/Problem solving		
67	Elementary solutions of Laplace equation	Lecture/Problem solving		
68	Elementary solutions of Laplace equation	Problem solving		
69	problems	Problem solving		
70	problems	Problem solving		
71	revision	Problem solving		

72	revision	Problem solving		

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	14/9/2018	PROBLEMS BASED ON MODULE 1
2	14/10/2018	PROBLEMS BASED ON MODULE 2

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	28/10/2018	SOLUTION OF HIGHER ORDER PDE

Textbook

Ian Sneddon, Elements of partial differential equations, Mc Graw Hill Book Company

References

- **Partial Differential Equations, M D RaiSinghania**

Web resource references:

https://nptel.ac.in/courses/111/103/111103021/

COURSE PLAN

PROGRAMME	MASTER OF SCIENCE MATHEMATICS	SEMESTER	3
COURSE CODE AND TITLE	16P3MATT12- ADVANCED FUNCTIONAL ANALYSIS	CREDIT	4
HOURS/WEEK	5	HOURS/SEM	75
FACULTY NAME	M P SEBASTIAN		

COURSE OBJECTIVES

- To Analyze the basics of Functional analysis
- To apply Functional analysis in the other disciplines.
- To equip the students for NET
- To create counter examples
- To analyse practical problems

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
MODULE I				
1	Revision of Functional analysis 1	PPT		
2	Strong and weak convergence in a normed space	Problem solving		
3	Problems based on weak and strong convergence	Lecture		
4	Convergence of a sequence of operators and functionals	Problem solving		

5	Problems based on different types of convergence	Lecture		
6	Open mapping theorem	Problem solving		
7	Problems on open mapping theorem Closed linear operators and closed graph theorem	Lecture		
8	Problems based on Closed linear operators	Lecture		
9	Fixed point and fixed point theorem	Lecture		
10	Problems based on fixed point theorem	Lecture/Problem solving		
11	**TEST PAPER ON MODULE -1**			
12	Spectral theory of matrices , problems	Lecture/Problem solving		
13	**Spectral theory of linear operators on a finite dimensional normed space**	Lecture/Problem solving		
14	Basic concepts of spectral theory of a linear operator on a complex normed space	Lecture		
15	Revision of Functional analysis 1	Lecture/Problem solving		
16	problems	Lecture		
17	problems	Lecture/Problem solving		

MODULE II

18	Spectral properties of bounded linear operators , spectral radius	PPT/Lecture		
19	Further properties of resolvent and spectrum	Lecture		
20	Spectral mapping theorem for matrices ,and for polynomials			

21	Use of complex analysis in spectral theory , formula for spectral radius	Lecture		
22	Problems based on spectral radius,	Lecture		
23	Introduction of Banach algebra ,examples	Lecture/Problem solving		
24	**Properties of Banach algebra**	Lecture/Problem solving		
25	Problems on Banach algebra	Lecture/Problem solving		
26	Introduction of compact linear operators	Lecture/Problem solving		
27	Properties of compact linear operators	Lecture/Problem solving		
28	Properties of compact linear operators	Lecture/Problem solving		
29	**F**urther properties of compact linear operators , compactness of adjoint OPERATORS	Lecture/Problem solving		
30	Problems based on properties of compact linear operators	Lecture/Problem solving		
31	Spectral properties of compact linear operators	Lecture		
32	Problems based on spectral properties	Lecture/Problem solving		
33	Further properties of spectrum of a compact linear operator	Lecture/Problem solving		

34	**problems**	Lecture/Problem solving		
35	**problems**	Lecture		
36	**problems**	Lecture/Problem solving		
	MODULE III			
37	Further properties of spectrum of a compact linear operator	Lecture/Problem solving		
38	Problems	Lecture/Problem solving		
39	Problems	Lecture/Problem solving		
40	Problems	Lecture/Problem solving		
41	**problems**	Lecture/Problem solving		
42	Problems based on spectral properties	Lecture/Problem solving		
43	Problems	Lecture/Problem solving		
44	Problems	Lecture/Problem solving		
45	Problems	Lecture/Problem solving		
46	**Revision** of the basic properties of self adjoint , unitary and normal operators	Lecture/Problem solving		

47	Spectral properties of a bounded self adjoint linear operator			
48	Problems	Lecture/Problem solving		
49	Problems	Lecture/Problem solving		
50	Problems	Lecture/Problem solving		
51	Problems based on the spectrum of a bounded self adjoint linear OPERATOR	Lecture/Problem solving		
52	Further spectral properties of self adjoint operator and related, problems	Lecture/Problem solving		
53	Problems	Lecture/Problem solving		
54	Problems	Lecture/Problem solving		
55	Introduction of Positive operators	Lecture/Problem solving		
56	Properties of positive operators	Lecture/Problem solving		
57	Problems	Lecture/Problem solving		
58	Problems	Lecture/Problem solving		
59	Problems	Lecture/Problem solving		

60	Problems	Lecture/Problem solving		
61	Problems on positive operators	Lecture/Problem solving		
62	Square root of a positive operator and its properties	Lecture/Problem solving		
63	Problems	Lecture/Problem solving		
64	Problems	Lecture/Problem solving		
65	problems	Lecture/Problem solving		
66	problems	Lecture/Problem solving		
67	Problems on positive square root	Lecture/Problem solving		
68	Projection operators and its properties	Lecture/Problem solving		
69	Problems based on the properties of projection operators	Lecture/Problem solving		CO 5
70	Further properties of projections and related problems	Lecture/Problem solving		
71	problems	Lecture/Problem solving		
72 - 75	Problems from exercises	Lecture/Problem		

		solving		

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	14/9/2018	PROBLEMS BASED ON MODULE 1
2	14/10/2018	PROBLEMS BASED ON MODULE 2

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	28/10/2018	PROBLEMS ON MODULE 4

Textbook

INTRODUCTARY FUNCTIONAL ANALYSIS ,KREYSZIG

References

i) ROYDEN H real analysis 3rd edn ,Macmillan, new york 1988

ii) RUDIN.W Real and complex analysis, 3rd edn Macmillan, new York,1987

COURSE PLAN

PROGRAMME	MASTER OF SCIENCE MATHEMATICS	SEMESTER	3
COURSE CODE AND TITLE	16P3MATT13- Graph Theory	CREDIT	4
HOURS/WEEK	5	HOURS/SEM	75
FACULTY NAME	Jeet Kurian Mattam		

Course Objectives

- To Explain basic concepts, sub graphs, degrees of vertices. Paths and connectedness, automorphism of a simple graph, line graphs, basic concepts and tournaments.
- To Comprehend connectivity vertex cuts and edge cuts. Connectivity and edge connectivity, blocks. Certain definitions and simple properties, counting the number of spanning trees and Cayley's formula.
- To Analyze vertex and edge independent Sets, Eulerian Graphs, Hamiltonian Graphs, Vertex Coloring and certain definitions.
- To Explain edge coloring and planarity: certain definitions and properties, dual of a plane graph.
- To understand the four color theorem and the Heawood five color theorem

Text Book

1.A Text Book of Graph Theory by R. Balakrishnan and K. Ranganathan

Additional references

1) A First Look at Graph Theory by John Clark and Derek Allan Holton

2) Introduction to Graph Theory by Douglas B West

3) Graph Theory by Frank Harary

4) Graph Theory with Applications by J.A. Bondy and U.S.R. Murty

Sessions	Topic	Method	Remarks/Reference
1 **MODULE 1 BEGINS**	Sections 1.1.1-1.1.8	Group Discussion followed by a Lecture session.	
2	Sections 1.1.9-1.1.14	Lecture	
3	Sections :Definitions 1.2.1-1.3.6	Video Lecture	
4	Exercises 3.1-3.2, Definitions 1.3.7, Example 1.3.8, Example 1.3.9, Exercise 3.4	Lecture session with Examples	
5	Sections 1.4.1- 1.4.6,	Video Lecture	
6	Sections 1.4.7- 1.4.10		
7	Examples 1.4.11, Example 1.4.12, Definition 15.1, Theorem 1.5.2, Theorem 1.5.3 .	Lecture	
8	Exercise 5.1, Example 1.5.4, Exercises 5.4, Line Graphs and their basic properties.	Lecture	
9	Theorems 1.6.1, Exercise 6.1,6.2,6.3,6.4, Theorem 1.6.2 and Remark 1.6.3	Lecture	
10	Selected exercises on pages 31 and 32	Assignments for the students	
11	Definitions 2.1.1, 2.1.2 and 2.1.3, Exercises 1.1 and 1.2.		
12	Tournaments, Theorem 2.2.1		
13	Theorem 2.2.2, Remark 2.2.3 and Exercises 2.1-2.6	Lecture	
14	Definitions 3.1.1, Examples 3.1.2, Remarks 3.1.3-3.1.5, Theorems	Lecture	

	3.1.6-3.1.7		
15	Theorems 3.1.8, Remark 3.1.9, Theorem 3.1.10 .	Lecture	
16	Proposition 3.1.11, Definitions 3.2.1, Ex 2.1, Definitions 3.2.2, 3.2.3.	Lecture	
17	Theorem 3.2.4, Exercise 2.3, 2.4,2.5	Lecture	
22	Theorem 3.2.5, Exercise 2.6 Definitions 3.2.6 and Theorem 3.2.7	Lecture	
23	Theorem 3.2.8, Remark 3.2.9 Exercise 2.10 and Theorem 3.2.10	Lecture	
24	Theorem 3.2.11, Definitions 3.3.1, Remarks 3.3.2 and theorem 3.3.3	Lecture	
25	**FIRST CIA**	**I Hr Moodle Objective Test**	
26 **MODULE II** **BEGINS**	Definition of Trees; Remarks 4.1.1,Theorem 4.1.2, Definition of spanning Tree, Theorem 4.1.3, Theorem 4.1.4	Lecture and interactive session	
27	Theorem 4.1.5, Corollary 4.1.6, Exercises 1.2-1.4, Theorem 4.1.7		
28	Theorem 4.1.8, Lemma 4.1.9 and Example 4.1.10		
29	Exercises 1.5-1.7 and example 4.1.11		
30	Definitions 4.2.1, Example 4.2.2, Remark 4.2.3, Theorem 4.2.4	Seminar	
31	Definitions 4.2.5, Exercise 2.4, Definitions 4.3.1 and Theorem 4.3.2	Seminar	

32	Example 4.3.3 and related Exercises	Seminar	
33	Theorem 4.3.4, Corollary 4.3.5 and Corollary 4.3.6	Seminar	
34	Cayley's Formula		
35	Proof of Cayley's Formula continued		
36 **MODULE III BEGINS**	Definitions 5.1.1, 5.1.2, Theorem 5.1.3, Definition 5.1.4 and Corollary 5.1.5.		
37	Definitions 5.2.1, Remarks 5.2.2, Theorem 5.2.3, Exercises 2.1-2.3		
38	Definitions 6.1.1, Theorem 6.1.2 and remark.		
39	Theorem 6.1.3		
40	Proof of Theorem 6.1.3 continued. Corollary 6.1.4		
41	Proof of Corollary 6.1.4 contd. And Exercises 1.1- 1.5		
42-44	Definitions 6.2.1-6.2.2, Hamilton,' around the World Game, Theorem 6.2.4		
45	Exercises 2.1,2.2, The Petersen Graph is non Hamiltonian, Theorem 6.2.5		
46	Corollary 6.2.6,6.2.7, Theorem 6.2.8, Definition 6.2.9 and Theorem 6.2.10, Theorem 6.2.11		
47	Corollary 6.2.12, Theorem 6.2.13, Theorem 6.2.14		
48	Definition 7.1.1, 7.1.2,7.1.3, 7.1.4,		

	Exercise 1.1,1.2,1.4, Theorem 7.1.5		
49	Definition 7.2.1, Remarks 7.2.2, Exercises 2.1-2.5, Theorem 7.2.3 and Corollary 7.2.4		
50	Theorem 7.2.5, Corollary 7.2.6.,Brook's Theorem		
51	Brook's theorem Concluded		
52	Theorem 7.3.3, Remark 7.3.4		
53 **MODULE 4 BEGINS**	Definition 7.4.1,7.4.2 and Theorem 7.4.3		
54	Exercise 4.1 , Theorem 7.4.4		
55	Definitions 8.1.1, Example 8.1.2, Definitions 8.1.3		
56	Remarks 8.1.4, Theorem 8.1.5		
57	Theorem 8.1.6 and remarks 8.1.7		
58	Theorem 8.1.8 , Exercise 1.1-1.3	Lecture	
59	Theorem 8.2.1, Corollary 8.2.2,8.2.3	Lecture	
60	Example 8.2.4, Corollary 8.2.5, Theorem 8.2.6 and Corollary .8.2.7	Lecture	
61	Definition 8.2.9, 8.2.10 and Remark 8.2.11	Lecture	
62	Theorem 8.3.1, Remark 8.3.2	Lecture	
63	Theorem 8.3.3 remark 8.3.4	Lecture	
64	Dual of a plane graph	Lecture	

65	The Four color theorem	Lecture	
66	Theorem 8.5.1	Lecture	
67,68 and 69	Theorem 8.5.2	Lecture	
70		Lecture	
71		Lecture	
72		Lecture	
73	REVISION		
74	REVISION		
75	REVISION		

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	17/9/2018	PROBLEMS BASED ON MODULE 1
2	10/10/2018	PROBLEMS BASED ON MODULE 2

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	8/10/2018	PROBLEMS ON MODULE 3

COURSE PLAN

PROGRAMME	MASTER OF SCIENCE IN MATHEMATICS	SEMESTER	3
COURSE CODE AND TITLE	16P3MATT14 – Operation Research	CREDIT	4
HOURS/WEEK	5	HOURS/SEM	75
FACULTY NAME	JEENU KURIAN		

COURSE OBJECTIVES

- To Apply different mathematical method to solve Inventory problems.
- To Evaluate the optimal solution of Non - Integer programming problem by using different Algorithms.
- To Evaluate a Dynamic Programming Problem.
- To Apply simplex method to solve Linear Programming problem. Apply algorithm to find the solution of minimum path problem and maximum flow problem.

Prescribed Text

1 **Text - 1- K.V. Mital and C. Mohan, Optimization Methods in Operation Research and Systems Analysis, 3rd edition.**
2 **Text -2- Ravindran, Philips and Solberg. Operations Research Principle and Practice, 2nd edition, John Wiley and Sons.**
3 **Text - 3 -Man Mohan, P.K. Gupta and Kanti Swarup, Operations Research, Sultan Chand and Sons. Module I: INVENTORY MODELS**

Sessions	Topic	Method
1.	Module 1 - Introductory Session	Lecture
2.	Introductory session – Costs associated with inventory	Lecture
3.	Introductory session – Basic notations in inventory control	Lecture
4.	Factors affecting inventory	Lecture,

5.	Economic order quantity	Lecture,
6.	EOQ problems without shortage - equal time period	Lecture,
7.	Characteristics of the model	Lecture,
8.	EOQ problems without shortage - unequal time interval	Lecture, Group Discussion,
9.	Characteristics of the model	Lecture,
10.	EOQ problems without shortage - instantaneous production	Lecture, Group Discussion,
11.	Characteristics of the model	Lecture, Group Discussion,
12.	Deterministic inventory Problems with shortages - Fundamental Problem	Problem Solving
13.	Deterministic inventory Problems with shortages - Fixed time period	Lecture, Group Discussion, Problem Solving
14.	Deterministic inventory Problems with shortages - Instantaneous production	Problem Solving
15.	Characteristics of the model	Lecture
16.	EOQ problem with single price - breaks	Problem Solving
17.	EOQ problem with multiple price - breaks	Lecture, Group Discussion, Problem Solving
18.	Problems	Group discussion
19.	Problem solving sessions	Lecture, Group Discussion,

		Problem Solving
20.	Problem solving sessions	Lecture, Group Discussion, Problem Solving
21.	Module 2 : Introduction	Lecture, Group Discussion, Problem Solving
22.	Basic concepts of NLPP	GroupDiscussion, Problem Solving
23.	Taylors series in single variable and two variables	Lecture, Group Discussion, Problem Solving
24.	n- dimensional Taylors series	Lecture, Group Discussion, Problem Solving
25.	Fibonacci search method	Lecture, Group Discussion, Problem Solving
26.	Problems	Lecture, Group Discussion, Problem Solving
27.	Golden section search method	Lecture, Group Discussion,

		Problem Solving
28.	Problems	Lecture, Group Discussion, Problem Solving
29.	Hooke and Jeeves search algorithm	Lecture, Group Discussion, Problem Solving
30.	Problem	Lecture, Group Discussion, Problem Solving
31.	Gradient projection method	Lecture, Group Discussion, Problem Solving
32.	Problem	Lecture, Group Discussion, Problem Solving
33.	Newtons method	Lecture, Group Discussion, Problem Solving
34.	Problems	Problem Solving
35.	Problems	Lecture, Group Discussion, Problem Solving

36.	Kuhn-tucker conditions	Problem Solving
37.	Problems	Lecture, Group Discussion, Problem Solving
38.	Module 3 : Introduction of DPP	Problem Solving
39.	Minimum path problem	Lecture, Group Discussion, Problem Solving
40.	Single additive constraint, additively separable return	Lecture, Group Discussion, Problem Solving
41.	problems	Problem Solving
42.	Single multiplicative constraints, additively separable return	Lecture, Group Discussion, Problem Solving
43.	Problems	Problem Solving
44.	Single additive constraint, multiplicatively separable return	Lecture, Group Discussion, Problem Solving
45.	Problems	Lecture, Group Discussion, Problem Solving

46.	Examples of failure	Lecture, Group Discussion, Problem Solving
47.	Decomposition – backward and forward recursions	Lecture, Group Discussion, Problem Solving
48.	Theorems	Lecture, Group Discussion, Problem Solving
49.	Systems with more than one constraint	Lecture, Group Discussion, Problem Solving
50.	Problems	Lecture, Group Discussion, Problem Solving
51.	Problems	Lecture, Group Discussion, Problem Solving
52.	Problems	Lecture, Group Discussion, Problem Solving
53.	Module 4 - Introduction	Lecture, Group Discussion, Problem Solving

54.	I.L.P in two dimensional space	Lecture, Group Discussion, Problem Solving
55.	– General I.L.P. and M.I.L.P problems	Lecture, Group Discussion, Problem Solving
56.	Theorems	Lecture, Group Discussion, Problem Solving
57.	cutting planes - ILP	Lecture, Group Discussion, Problem Solving
58.	Problems	Lecture, Group Discussion, Problem Solving
59.	cutting planes - MILP	Lecture, Group Discussion, Problem Solving
60.	Branch and Bound method	Lecture, Group Discussion, Problem Solving
61.	Problems solving	Lecture, Group Discussion,
62.	Problems solving	Lecture, Group Discussion,

63.	Introduction to Graphs	Lecture,
64.	Definitions and notations	Lecture,
65.	minimum path problem	Lecture,
66.	Problems	Lecture, Group Discussion,
67.	Minimum path problem with arborescence	Lecture,
68.	Problems	Lecture,
69.	Spanning tree of minimum length	Lecture,
70.	Problems	Lecture, Group Discussion,
71.	Problem of minimum potential difference	Lecture,
72.	Problems	Lecture,
73.	scheduling of sequential activities	Lecture,
74.	Maximum flow problem, algorithm	Lecture,
75.	Problems	Lecture,
76.	Theorems	Lecture,
77.	Maximum flow minimum cut theorem	Lecture,
78.	Revision	
79.	Revision	
80.	Revision	
81.	Revision	

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	15/7/2018	PROBLEMS BASED ON MODULE 1
2	14/8/2018	PROBLEMS BASED ON MODULE 2

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	20/10/2018	PROBLEMS ON MODULE 4

References:

1. S.S.Rao, Optimization Theory and Applications, 2nd edition, NewAge International Pvt.
2. J.K.Sharma, Operations Research : Theory and Applications, Third Edition, Macmillan IndiaLtd

COURSE PLAN

PROGRAMME	MASTER OF SCIENCE IN MATHEMATICS	SEMESTER	3
COURSE CODE AND TITLE	16P3MATT15 – Number Theory	CREDIT	4
HOURS/WEEK	5	HOURS/SEM	75
FACULTY NAME	DIDIMOS K V		

COURSE OBJECTIVES

- To Classify arithmetic function with their average orders.
- To Explain equivalent forms of prime number theorem.
- To Determine the solutions of polynomial congruences and simultaneous linear congruences.
- To Analyze factorization into irreducibles in Euclidean Domains and quadratic fields.
- To Analyze prime factorization of Ideals, the norm of an ideal, non-unique factorization of cyclotomic fields.

Text Book

1. Introduction to Analytic Number Theory, Tom M Apostol, Springer International Student Edition.
2. Algebraic Number Theory and Fermat's Last Theorem, Ian Stewart and David Tall, Third Edition.

No of Hours	Topic	Method	Remarks/Reference
1	The Mobius function, The Euler totient function	Lecture, Group Discussion, Problem SolvingLecture	Module-1 (25 Hours)
2	The Dirichlet product of arithmetical functions, Dirichlet inverses and Mobius inversion formula	Lecture, Group Discussion, Problem Solving	
2	The Mangoldt function	Lecture, Group Discussion, Problem Solving	

	Multiplicative functions and Dirichlet multiplication		
2	The inverse of completely multiplicative functions	Lecture, Group Discussion, Problem Solving	
3	The Liovillie's function ,The divisor function, Generalized convolutions	Lecture, Group Discussion, Problem Solving	
1	The big oh notation, Asymptotic equality of functions	Lecture, Group Discussion, Problem Solving	
3	Euler's summation formula, Some elementary asymptotic formulas	Lecture, Group Discussion, Problem Solving	
3	The average order of d(n), The average order of the divisor function, Average order of $\varphi(n)$	Lecture, Group Discussion, Problem Solving	
1	An application of distribution of lattice points visible from the origin	Lecture, Group Discussion, Problem Solving	
2	Averageorder of $\mu(n)$ and of $\Lambda(n)$	Lecture, Group Discussion, Problem Solving	
2	The partial sums of a Dirichlet product	Lecture, Group Discussion, Problem Solving	
3	Application to$\mu(n)$ and $\Lambda(n)$	Lecture, Group Discussion, Problem Solving	
1	Chebyshev's functions $\Psi(x)$ and $\theta(x)$	Lecture, Group Discussion, Problem Solving	Module-2 (18 Hours)
1	Relation connecting $\Psi(x)$ and $\pi(x)$	Lecture, Group Discussion, Problem Solving	
2	Some equivalent forms of prime number theorem	Lecture, Group Discussion, Problem Solving	
2	Inequalities of $\pi(n)$ and p_n	Lecture, Group Discussion, Problem Solving	
2	Definition and basic properties of congruences	Lecture, Group Discussion, Problem Solving	
1	residue classes and complete residue systems	Lecture, Group Discussion, Problem Solving	

1	liner congruences	Lecture, Group Discussion, Problem Solving	
2	Reduced residue systems and Euler – Fermat theorem	Lecture, Group Discussion, Problem Solving	
1	Polynomial congruences modulo	Lecture, Group Discussion, Problem Solving	
3	Lagrange's theorem, applications of Lagrange's theorem	Lecture, Group Discussion, Problem Solving	
1	Simultaneous linear congruences	Lecture, Group Discussion, Problem Solving	
1	The Chinese reminder theorem.	Lecture, Group Discussion, Problem Solving	
2	Trivial FactorizationsFactorization into Irreducibles	Lecture, Group Discussion, Problem Solving	Module-3 (17 Hours)
3	Examples of Non-Unique Factorization into Irreducibles	Lecture, Group Discussion, Problem Solving	
4	Prime Factorization	Lecture, Group Discussion, Problem Solving	
5	Euclidean Domains	Lecture, Group Discussion, Problem Solving	
3	Euclidean Quadratic Fields.	Lecture, Group Discussion, Problem Solving	
6	Prime Factorization of Ideals	Lecture, Group Discussion, Problem Solving	Module-4 (15 Hours)
6	The Norm of an Ideal	Lecture, Group Discussion, Problem Solving	
3	Nonunique Factorization of Cyclotomic Fields.	Lecture, Group Discussion, Problem Solving	
Total = 75 hours			

ASSIGNMENTS/EXERCISES – Details & Guidelines

	Date of submission/completion	**Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)**
1.	1 October 2018	Problems on Number Theory