SACRED HEART COLLEGE (AUTONOMOUS)

Department of Mathematics

MSc Mathematics

Course Plan

2018 – 19

Semester 4

COURSE PLAN

PROGRAMME	M.Sc. MATEMATICS	SEMESTER	4
COURSE CODE AND TITLE	16P4MATT16EL : DIFFERENTIAL GEOMETRY	CREDIT	4
HOURS/WEEK	5	HOURS/SEM	75
FACULTY NAME	Dr. DIDIMOS K. V.		

Course Objectives

- Perceive ideas of Graphs and level sets, vector fields, the tangent space, surfaces, vector
  fields on surfaces, orientation
- Understand the fundamentals of The Gauss map, geodesics, Parallel transport
- Assimilate the ideas of the Weingarten map, curvature of plane curves, Arc length and line integrals
- Developing skills related to Curvature of surfaces

Text Book

1 Tom Apostol, Mathematical Analysis (second edition), Narosa Publishing House.

2 Walter Rudin, Principles of Mathematical Analysis (Third edition), International Student Edition.

Sessions	Topic	Method	Remarks
1	Graphs and level sets	Lecture, Group Discussion, Problem Solving Lecture	
2	Graphs and level sets	Lecture, Group Discussion, Problem Solving Lecture	
3	vector fields	Lecture, Group Discussion, Problem Solving Lecture	
4	vector fields	Lecture, Group Discussion, Problem Solving Lecture	
5	The tangent space	Lecture, Group Discussion, Problem Solving Lecture	
6	The tangent space	Lecture, Group Discussion, Problem Solving	
7	The tangent space	Lecture, Group Discussion, Problem Solving	
8	The tangent space	Lecture, Group Discussion, Problem Solving	
9	Surfaces	Lecture, Group Discussion, Problem Solving	
10	Surfaces	Lecture, Group Discussion, Problem Solving	
11	Surfaces	Lecture, Group Discussion, Problem Solving	
12	Surfaces	Lecture, Group Discussion, Problem Solving	
13	Surfaces	Lecture, Group Discussion, Problem Solving	
14	Surfaces	Lecture, Group Discussion, Problem Solving	
15	Vector fields on surfaces, orientation.	Lecture, Group Discussion, Problem Solving	
16	Vector fields on surfaces, orientation.	Lecture, Group Discussion, Problem Solving	
17	Vector fields on surfaces, orientation.	Lecture, Group Discussion,	

		Problem Solving	
18	Vector fields on surfaces, orientation.	Lecture, Group Discussion, Problem Solving	
19	Vector fields on surfaces, orientation.	Lecture, Group Discussion, Problem Solving	
20	Vector fields on surfaces, orientation.	Lecture, Group Discussion, Problem Solving	
21	The Gauss map	Lecture, Group Discussion, Problem Solving	
22	The Gauss map	Lecture, Group Discussion, Problem Solving	
23	The Gauss map	Lecture, Group Discussion, Problem Solving	
24	The Gauss map	Lecture, Group Discussion, Problem Solving	
25	Geodesics	Lecture, Group Discussion, Problem Solving	
26	Geodesics	Lecture, Group Discussion, Problem Solving	
27	Geodesics	Lecture, Group Discussion, Problem Solving	
28	Geodesics	Lecture, Group Discussion, Problem Solving	
29	Geodesics	Lecture, Group Discussion, Problem Solving	
30	Parallel transport	Lecture, Group Discussion, Problem Solving	
31	Parallel transport	Lecture, Group Discussion, Problem Solving	
32	Parallel transport	Lecture, Group Discussion, Problem Solving	
33	Parallel transport	Lecture, Group Discussion, Problem Solving	
34	Parallel transport	Lecture, Group Discussion,	

		Problem Solving	
35	Parallel transport	Lecture, Group Discussion, Problem Solving	
36	The Weingarten map	Lecture, Group Discussion, Problem Solving	
37	The Weingarten map	Lecture, Group Discussion, Problem Solving	
38	The Weingarten map	Lecture, Group Discussion, Problem Solving	
39	The Weingarten map	Lecture, Group Discussion, Problem Solving	
40	The Weingarten map	Lecture, Group Discussion, Problem Solving	
41	The Weingarten map	Lecture, Group Discussion, Problem Solving	
42	Curvature of plane curves	Lecture, Group Discussion, Problem Solving	
43	Curvature of plane curves	Lecture, Group Discussion, Problem Solving	
44	Curvature of plane curves	Lecture, Group Discussion, Problem Solving	
45	Curvature of plane curves	Lecture, Group Discussion, Problem Solving	
46	Curvature of plane curves	Lecture, Group Discussion, Problem Solving	
47	Curvature of plane curves	Lecture, Group Discussion, Problem Solving	
48	Curvature of plane curves	Lecture, Group Discussion, Problem Solving	
49	Arc length and line integrals	Lecture, Group Discussion, Problem Solving	
50	Arc length and line integrals	Lecture, Group Discussion, Problem Solving	
51	Arc length and line integrals	Lecture, Group Discussion,	

		Problem Solving	
52	Arc length and line integrals	Lecture, Group Discussion, Problem Solving	
53	Arc length and line integrals	Lecture, Group Discussion, Problem Solving	
54	Arc length and line integrals	Lecture, Group Discussion, Problem Solving	
55	Arc length and line integrals	Lecture, Group Discussion, Problem Solving	
56	Curvature of surfaces	Lecture, Group Discussion, Problem Solving	
57	Curvature of surfaces	Lecture, Group Discussion, Problem Solving	
58	Curvature of surfaces	Lecture, Group Discussion, Problem Solving	
59	Curvature of surfaces	Lecture, Group Discussion, Problem Solving	
60	Curvature of surfaces	Lecture, Group Discussion, Problem Solving	
61	Curvature of surfaces	Lecture, Group Discussion, Problem Solving	
62	Curvature of surfaces	Lecture, Group Discussion, Problem Solving	
63	Parametrized surfaces	Lecture, Group Discussion, Problem Solving	
64	Parametrized surfaces	Lecture, Group Discussion, Problem Solving	
65	Parametrized surfaces	Lecture, Group Discussion, Problem Solving	
66	Parametrized surfaces	Lecture, Group Discussion, Problem Solving	
67	Parametrized surfaces	Lecture, Group Discussion, Problem Solving	
68	Parametrized surfaces	Lecture, Group Discussion,	

		Problem Solving	
69	Parametrized surfaces	Lecture, Group Discussion, Problem Solving	
70	local equivalence of surfaces and Parametrized surfaces	Lecture, Group Discussion, Problem Solving	
71	local equivalence of surfaces and Parametrized surfaces	Lecture, Group Discussion, Problem Solving	
72	local equivalence of surfaces and Parametrized surfaces	Lecture, Group Discussion, Problem Solving	
73	local equivalence of surfaces and Parametrized surfaces	Lecture, Group Discussion, Problem Solving	
74	local equivalence of surfaces and Parametrized surfaces	Lecture, Group Discussion, Problem Solving	
75	local equivalence of surfaces and Parametrized surfaces	Lecture, Group Discussion, Problem Solving	

1 ASSIGNMENTS/EXERCISES – Details & Guidelines

	Date of submission/completion	**Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)**
1.	12 March 2019	Problems on Differential Geometry

2. References:-

1. Serge Lang, Differential Manifolds
2. I.M. Siger, J.A Thorpe, Lecture notes on Elementary topology and Geometry, Springer (1967)
3. S. Sternberg, Lectures on Differential Geometry, Prentice-Hall, 1964.
4. M. DoCarmo, Differential Geometry of curves and surfaces.
5. Goursat, Mathematical Analysis, Vol – 1(last two chapters)

COURSE PLAN

PROGRAMME	MSc Mathematics	SEMESTER	4
COURSE CODE AND TITLE	16P4MATT17EL MULTIVARIATE CALCULUS AND INTEGRAL TRANSFORMS	CREDIT	4
HOURS/WEEK	5	HOURS/SEM	90
FACULTY NAME	SANIL JOSE		

Course Objectives

- To Explain Weirstras theorem, otherforms of Fourierseries, the Fourier integral theorem, the exponential form of the Fourier integral theorem, integral transforms and convolutions, the convolution theorem for Fourier transforms.

- To Analyze Multivariable Differential Calculus The directional derivative, directional derivatives and continuity, the total derivative, the total derivative expressed in terms of partial derivatives, An application of complex- valued functions, the matrix of a linear function, the Jacobian matrix, the chain rate matrix form of the chain rule.

- To Interpret Implicit functions and extremum problems, the mean value theorem for differentiable functions, a sufficient condition for differentiability.

- To Explain Integration of Differential Forms, primitive mappings, partitions of unity, change of variables, differential forms, Stokes theorem.

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
MODULE 1				
1	INTRODUCTION	Lecture		
2	THE WEIRSTRASS THEOREM	Lecture		
3	OTHER FORMS OF FOURIER SERIES	Lecture, Problem Solving		
4	THE FOURIER INTEGRAL THEOREM	Lecture, Problem Solving		
5	THE EXPONENTIAL FORM OF FORIER SERIES	Lecture,		
6	INTEGRAL TRANSFORMS	Lecture Problem Solving		
7	CONVOLUTION	Lecture, Problem Solving		
8	SEMINAR	Lecture, Problem Solving		
9	SEMINAR	Lecture, Problem Solving		
10	PROBLEMS	Lecture, Problem Solving		
11	PROBLEMS	Lecture, Problem Solving		
12	TUTORIAL	Lecture		
13	SEMINAR	Lecture, Problem		

		Solving		
14	QUESTION PAPER REVISION	Lecture, Problem Solving		
MODULE 2				
15	THE DIRECTIONAL DERIVATIVE	Lecture, Problem Solving		
16	CONTINUITY	Lecture, Problem Solving		
17	TOTAL DERIVATIVE	Lecture, Problem Solving		
18	TOTAL DERIVATIVE AS PARTIAL DERIVATIVES	Lecture, Problem Solving		
19	TOTAL DERIVATIVE AS PARTIAL DERIVATIVES	Lecture, Problem Solving		
20	APPLICATION TO COMPLEX NUMBERS	Test		
21	APPLICATION TO COMPLEX NUMBERS	Lecture, Problem Solving		
22	MATRIX FORM	Lecture, Problem Solving		
23	MATRIX FORM	Lecture, Problem Solving		
CIA 1				

24	JACOBIAN MATRIX	Lecture, Problem Solving		
25	CHAIN RULE MATRIX FORM	Lecture, Problem Solving		
26	CHAIN RULE MATRIX FORM	Lecture, Problem Solving		
27	SEMINAR	Lecture, Problem Solving		
28	SEMINAR	Lecture, Problem Solving		
29	PROBLEMS			
30	PROBLEMS	Lecture, Problem Solving		
31	TUTORIAL	Lecture, Problem Solving		
32	MEAN VALUE THEOREM	Lecture, Problem Solving		
33	MEAN VALUE THEOREM	Lecture, Problem Solving		
34	SUCCIFIENT CONDITION FOR DIFFERENTIABILITY	Introduction		
35	SUCCIFIENT CONDITION FOR DIFFERENTIABILITY	Lecture, Problem Solving		
36	MIXED DERIVATIVE THEOREM	Lecture, Problem Solving		
37	INVERSE FUNCTION THEOREM	Lecture, Problem Solving		
38	IMPLICIT FUNCTION	Lecture,		

	THEOREM	Problem Solving		
39	EXTREMA OF REAL VALUED FUNCTIONS			
40	EXTREMA OF REAL VALUED FUNCTIONS	Lecture, Problem Solving		
41	SEMINAR	Lecture, Problem Solving		
42	SEMINAR	Lecture, Problem Solving		
43	PROBLEMS	Lecture, Problem Solving		
44	PROBLEMS	Lecture, Problem Solving		
45	TUTORIAL	Lecture, Problem Solving		
46	SEMINAR	Lecture, Problem Solving		
47	SEMINAR	Lecture, Problem Solving		
48	SEMINAR	Lecture, Problem Solving		
49	SEMINAR	Lecture, Problem Solving		
50	SEMINAR	Lecture, Problem Solving		
51	SEMINAR	Lecture, Problem Solving		

52	SEMINAR	Lecture, Problem Solving		
53	SEMINAR	Lecture, Problem Solving		
54	SEMINAR	Lecture, Problem Solving		
MODULE 4				
55	PRIMITIVE MAPPING	Lecture, Problem Solving		
56	PARTITION OF UNITY	Lecture, Problem Solving		
57	PARTITION OF UNITY	Lecture, Problem Solving		
58	CHANGE OF VARIABLES	Lecture, Problem Solving		
59	DIFFERENTIAL FORMS	Lecture, Problem Solving		
60	STOKES THEOREM	Lecture, Problem Solving		
61	STOKES THEOREM	Lecture, Problem Solving		
62	STOKES THEOREM	Lecture, Problem Solving		
63	SEMINAR	Lecture, Problem Solving		
64	SEMINAR	Lecture, Problem		

		Solving		
65	SEMINAR	Lecture, Problem Solving		
66	SEMINAR	Lecture, Problem Solving		
67	SEMINAR	Lecture, Problem Solving		
68	SEMINAR	Lecture, Group Discussion		
69	SEMINAR	Lecture, Group Discussion		
70	SEMINAR	Lecture, Group Discussion		
71	SEMINAR	Lecture, Group Discussion		
72 - 90	SEMINAR	Lecture, Group Discussion		

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	4/1/2019	Problems from module 1 and 2
2	28/1/2019	Problems from module 4

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
2/2/2019	PROBLEMS IN MODULE 3

RECOMMENDED BOOKS:

1. Rudin, W., Principles of Mathematical Analysis, 3rd Edition. New Delhi: McGraw-Hill Inc., 2013.

2. Royden, H.L. and Fitzpatrick, P.M., Real Analysis, 4th Edition. New Delhi: Pearson, 2010.

3. Carothers, N. L., Real Analysis, Cambridge University Press, 2000.

4. Apostol, T.M., Mathematical Analysis –A modern approach to Advanced Calculus. New Delhi: Narosa Publishing House, 1957.

5. Bartle, Robert G. and Sherbert, Donald R., Introduction to Real Analysis, 3rd Edition. Wiley, 1999. 6. Hugh, C.C., Real Mathematical Analysis. Springer, 2003.

7. Abbott, S., Understanding Analysis, 2nd Edition. Springer, 2016

8. Avner Friedman, "Foundations of Modern Analysis", Hold Rinehart Winston, 1970.

9 . Rana I. K., "An Introduction to Measure and Integration", Narosa Publishing House Pvt. Ltd., Second Edition, 2007.

COURSE PLAN

PROGRAMME	MASTER OF SCIENCE MATHEMATICS	SEMESTER	4
COURSE CODE AND TITLE	16P4MATT18EL- COMBINATORICS	CREDIT	4
HOURS/WEEK	5	HOURS/SEM	75
FACULTY NAME	MARIA SEBASTIAN		

Course Objectives

- To Analyze permutations and combinations & its applications.
- To Explain Pigeonhole principle and Ramsey numbers and its applications.
- To Apply generating functions and its implications.
- To Analyze recurrence relation and methods to solve that.

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
MODULE I				
1	Two basic counting principles	PPT		
2	Problems	Problem solving		
3	Problems, Permutations	Lecture		
4	Problems	Problem solving		
5	Circular permutations and Principle of complementation and problems	Lecture		
6	Problems, Combinations	Problem solving		
7	Problems , S(n, r)	Lecture		
8	Problems , Injection and bijection principle	Lecture		
9	Problems	Lecture		
10	Arrangements and problems	Lecture/Problem solving		

11	Selection with repetitions	Lecture		
12	Problems	Lecture/Problem solving		
13	Distribution problems-different cases	Lecture/Problem solving		
14	Problems	Lecture		
15	Extra problems from exercise	Lecture/Problem solving		
16	Extra problems from exercise	Lecture		
17	Introduction to binomial coefficients	Lecture/Problem solving		
	MODULE II			
18	Introduction to pigeonhole principle	PPT/Lecture		
19	Basic problems based on PP	Lecture		
20	More examples on PP			
21	Problems	Lecture		
22	Ramsey type problems	Lecture		
23	More problems and Ramsey numbers	Lecture/Problem solving		
24	Problems, Generalised Pigeonhole Principle	Lecture/Problem solving		
25	Theorems on Bounds for Ramsey numbers	Lecture/Problem solving		
26	Theorems on Bounds for Ramsey numbers	Lecture/Problem solving		
27	Theorems on Bounds for Ramsey numbers	Lecture/Problem solving		
28	Problems	Lecture/Problem solving		
29	Problems	Lecture/Problem solving		
30	Extra problems from exercise	Lecture/Problem solving		
	CIA-1			
31	Basic Inclusion and Exclusion principle	Lecture		
32	Principle of inclusion and exclusion(PIE) and its proof	Lecture/Problem solving		
33	Problems	Lecture/Problem solving		
34	Generalisation of PIE and problems	Lecture/Problem solving		
35	Generalised Principle of inclusion and exclusion(GPIE) and proof	Lecture		
36	Problems	Lecture/Problem solving		
	MODULE III			
37	Generalised Principle of inclusion and exclusion(GPIE)	Lecture/Problem solving		
38	Problems	Lecture/Problem		

		solving		
39	Extra problems from exercise	Lecture/Problem solving		
40	Shortest route problem	Lecture/Problem solving		
41	Integer solutions for an equation	Lecture/Problem solving		
42	More problems	Lecture/Problem solving		
43	Surjective mappings	Lecture/Problem solving		
44	Sterling numbers of second kind	Lecture/Problem solving		
45	Derangements and problems	Lecture/Problem solving		
46	Generalisation of Derangements	Lecture/Problem solving		
47	Problems	Lecture/Problem solving		
48	Test	Lecture/Problem solving		
49	Ordinary generating functions ,Cauchy product	Lecture/Problem solving		
50	Examples	Lecture/Problem solving		
51	Generating functions for different sequences	Lecture/Problem solving		
52	Problems	Lecture/Problem solving		
53	Some modeling problems	Lecture/Problem solving		
54	Examples	Lecture/Problem solving		
Module-IV				
55	Partitions of integers	Lecture/Problem solving		
56	Theorems based on partitions	Lecture/Problem solving		
57	Ferrers Diagram and problems	Lecture/Problem solving		
58	Theorems and problems	Lecture/Problem solving		
59	Exponential generating functions and examples	Lecture/Problem solving		
60	Exponential generating functions for permutations and examples	Lecture/Problem solving		
61	More examples	Lecture/Problem solving		
62	Distribution problems	Lecture/Problem solving		

63	Problems from exercise	Lecture/Problem solving		
64	Introduction to recurrence relations	Lecture/Problem solving		
CIA - II				
65	Tower of Hanoi problem	Lecture/Problem solving		
66	Finding number of parallelograms in the nth sub-division of an equilateral triangle	Lecture/Problem solving		
67	Method to solve Linear homogenous recurrence relations	Lecture/Problem solving		
68	Method to solve General Linear recurrence relations	Problem solving		
69	Number of ways of colouring a circle with n sectors using k colours with certain conditions	Problem solving		
70	problems	Problem solving		
71	Finding the determinant of a special type matrix using recurrence relation	Problem solving		
72 - 75	Extra problems	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	21/12/2018	PROBLEMS BASED ON MODULE 1
2	15/1/2019	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	20/2/2019	Recurrence relations

Textbook

CHEN CHUAN-CHONG ,KOH KHEE MENG,PRINCIPLES AND TECHNIQUES IN COMBINATORICS,WORLD SCIENTIFIC,1999.

References

Applied Combinatorics

Mitchel T. Keller, Washington and Lee University

William T. Trotter, Georgia Institute of Technology

Web resource references:

https://nptel.ac.in/courses/106/108/106108051/

COURSE PLAN

PROGRAMME	MASTER OF SCIENCE MATHEMATICS	SEMESTER	4
COURSE CODE AND TITLE	**16P4MATT19EL- THEORY OF WAVELETS**	CREDIT	4
HOURS/WEEK	5	HOURS/SEM	75
FACULTY NAME	M P SEBASTIAN		

Course Objectives

- Analyze the basics of Wavelet theory.
- Analyze various applications of wavelets
- Apply wavelet theory in Linear algebra.
- Summarize the scope of wavelet theory in the field of medical science.
- Explain the concepts of Haar measure

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
MODULE I				
1	Fundamentals of vector spaces and metric spaces	PPT		
2	Linear transformations and its matrix representations	Problem solving		
3	$l^2(N)$ and $l^2(Z_N)$	Lecture		
4	Introduction of the orthonormal basis $\{E_1, E_2, E_3, \ldots\ldots, E_{N-1}\}$	Problem solving		
5	The properties of the above basis	Lecture		
6	Introduction of the fourier basis F	Problem solving		
7	Introduction of discrete fourier transform	Lecture		
8	Matrix representation of the discrete fourier transform	Lecture		
9	Inverse discrete Fourier transform and its matrix representation	Lecture		
10	Translation by k operator and its Fourier transform	Lecture/Problem solving		
11	Conjugate of a vector and its Fourier transform	Lecture		
12	Translation invariant linear transformation	Lecture/Problem solving		
13	The result saying that a translation invariant linear transformation is diagonalizable	Lecture/Problem solving		
14	Convolution of two vectors in $l^2(Z_N)$	Lecture		
15	Convolution operator and the lemma showing that a convolution operator is translation invarient	Lecture/Problem solving		

16	The Dirac delta function and its properties	Lecture		
17	The DFT of convolution	Lecture/Problem solving		
	MODULE II			
18	Spatially localized and frequency localised bases of $l^2(Z_N)$	PPT/Lecture		
19	Conjugate reflection and its DFT	Lecture		
20	Components of a convolution in terms of inner products			
21	The necessary and sufficient condition for $\{R_k w\}_{k=0}^{N-1}$ to be an orthonormal basis for $l^2(Z_N)$	Lecture		
22	Introduction of first stage wavelet basis for $l^2(Z_N)$	Lecture		
23	Introduction of z* and its DFT	Lecture/Problem solving		
24	The necessary and sufficient condition for $\{R_k w\}_{k=0}^{M-1}$ to be an orthonormal set with M elements	Lecture/Problem solving		
25	Introduction of the system matrix A(n) of two vectors u and v	Lecture/Problem solving		
26	The necessary and sufficient condition for two vectors u and v to generate a first stage wavelet basis for $l^2(Z_N)$	Lecture/Problem solving		
27	Some examples of first stage wavelet basis	Lecture/Problem solving		
28	Description of first Shannon basis and first stage real Shannon basis	Lecture/Problem solving		
29	Introduction with sufficient explanations of first stage Haar basis	Lecture/Problem solving		
30	Lemma 3.12	Lecture/Problem solving		
	CIA-1			
31	Up sampling and down sampling operators and their properties	Lecture		
32	Introduction of filter bank diagram , its analysis phase and synthesis phase , perfect reconstruction in the filter bank	Lecture/Problem solving		
33	Lemma 3.15	Lecture/Problem solving		
34	The iteration steps in the construction of filter bank diagram	Lecture/Problem solving		
35	Introduction of p^{th} stage wavelet filter sequence	Lecture		
36	The derivation of the output of the p^{th} stage filter bank using down sampling operators	Lecture/Problem solving		
	MODULE III			
37	The theory used for the reconstruction of the filter bank, the diagram representing the reconstruction phase using up sampling operators	Lecture/Problem solving		
38	Lemma3.18	Lecture/Problem solving		
39	Definition of D^l and U^l Corollary 3.19	Lecture/Problem solving		

40	Introduction of f_l, g_l Definition 3.20	Lecture/Problem solving		
41	Lemma 3.21	Lecture/Problem solving		
42	Lemma 3.22	Lecture/Problem solving		
43	Introduction of p^{th} stage wavelet basis for $l^2(Z_N)$	Lecture/Problem solving		
44	Lemma3.24	Lecture/Problem solving		
45	Orthogonal direct sum of two subspaces of an inner product space and a problem from exercise	Lecture/Problem solving		
46	Lemma 3.26	Lecture/Problem solving		
47	The theorem saying that a p^{th} stage wavelet filter sequence can produce a p^{th} stage wavelet basis . Theorem 3.27	Lecture/Problem solving		
48	A new symbolic representation of the p^{th} stage wavelet basis	Lecture/Problem solving		
49	The folding lemma	Lecture/Problem solving		
50	Corollary 3.31	Lecture/Problem solving		
51	The p^{th} stage Haar system	Lecture/Problem solving		
52	The p^{th} stage Shannon wavelet basis for $l^2(Z_N)$	Lecture/Problem solving		
53	The p^{th} stage real Shannon wavelet basis	Lecture/Problem solving		
54	Daubechies's D6 wavelets on Z_N	Lecture/Problem solving		
Module-IV				
55	Definition of Cauchy sequence , Complete inner product space, Hilbert space , symmetric partial sum , the convergence of the series in the form $\sum_{n\in Z} w(n)$	Lecture/Problem solving		
56	Definition of S_A and $P_S(f)$	Lecture/Problem solving		
57	Lemma 4.14	Lecture/Problem solving		
58	The Hilbert space $L^2([-\pi,\pi))$, Cauchy – Schwarz inequality and triangle inequality	Lecture/Problem solving		
59	Introduction of $L^1([-\pi,\pi))$, $L^2([-\pi,\pi))$ is a proper subset of $L^1([-\pi,\pi))$	Lecture/Problem solving		
60	Introduction of the trigonometric system, and proving that it is an orthonormal set	Lecture/Problem solving		
61	The trigonometric system is complete	Lecture/Problem solving		
62	Definition 4.23 and corollary 4.24	Lecture/Problem		

		solving		
63	Bounded linear transformation between Hilbert spaces and lemma 4.26	Lecture/Problem solving		
64	Introduction of translation operator and translation invariant linear transformation	Lecture/Problem solving		
CIA - II				
65	problems	Lecture/Problem solving		
66	Theorem 4.28	Lecture/Problem solving		
67	FOURIER TRANSFORM , INVERSE FOURIER TRANSFORM and convolution on $l^2(Z)$	Lecture/Problem solving		
68	Lemma 4.31	Lecture/Problem solving		
69	Definition of summable sequences and the normed space $l^1(Z)$	Lecture/Problem solving		
70	The translation operator R_k and translation invariant linear transformation on $l^2(Z)$, example 4.37	Lecture/Problem solving		
71	The delta function and lemma 4.39	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	14/12/2018	PROBLEMS BASED ON MODULE 1
2	14/1/2019	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	12/2/2019	PROBLEMS ON MODULE 4