## M.Sc (Mathematics) Semester - I

	1. Name of th	e Department: Mathen	natics and Statistic	:s									
2.	Course Name	Real Analysis				L	Т	Р					
3.	Course Code	MT406				3	1	0					
4.	Type of Course (use tick	mark)	Core (□)	DSE ()		AEC ()	SEC ()	OE ()					
5.	Pre-requisite (if any)	B. Sc. with Mathematics	6. Frequency (use tick marks)	Even ()		Odd (□)	Either Sem ()	Every Sem ()					
	7. Total Num	ber of Lectures, Tutori	als, Practicals	1			1						
Le	ctures = 30		Tutorials = 10 Practical = Nil										
	<ul> <li>2. The course will help the student to understand sequence and Series of functions (convergent and uniform convergent),</li> <li>3. The course will also develop an understanding to solving Riemann Stieltjes integral and Power series.</li> <li>4. The course will further develop understanding the concepts of Cauchy criterion for uniform convergence.</li> <li>9. COURSE OUTCOMES (CO):</li> <li>After the successful course completion, learners will develop following attributes:</li> </ul>												
CO	COURSE OUTCOME (CO) ATTRIBUTES												
CO1 Students will gain an understanding of countability of Sets, Lebesgue measure on the real Length of intervals, open and closed sets on real line. They will also learn about outer and i Lebesgue measure, Lebesgue measurable sets and properties of measurable sets													
	CO2	Students will convergence, test, Abel's an and integration	students will be able to understand Sequence and Series of functions, Pointwise and uniform convergence, Cauchy criterion for uniform convergence. They will learn to define Weierstrass M test, Abel's and Dirichlet's test, for uniform convergence and differentiation, Uniform convergence and integration.										
	СО3	Students will of theorem of in Properties and	create the own under tegral calculus, D some important th	erstanding of efinition an eorems on R	f Weiers d existe eimann s	trass approx nce of Poi Stieltjes inte	imation theorem, ntwise and unifo gral.	The fundamental rm convergence,					
	<b>CO4</b>	Students will b series. They Rearrangemen	be able to understa will also learn t of terms of series	nd the conce about Abel	epts of P l's and	ower series Taylor's	and Uniqueness t theorem, Riemar	heorem of power in's theorem &					
	C05	Students will learn about Ja Students will a able to know a	create the own un cobian, chain rule llso be able to unde bout Riemann's th	derstanding , interchange rstand inver eorem, funct	of partia e of the se functi ions of s	I derivative order of di on theorem everal varia	es and total deriv fferentiation & hi and implicit funct bles and linear tra	atives. They will gher derivatives. ion. They will be nsformation.					
	10. Unit wise d	etailed content	1										
Un	tit-1 Numb Countability of S Lebesgue measur	<b>ber of lectures = 08</b> ets, Lebesgue measure c re, Lebesgue measurable	Title ofon the real line, Lere sets & Properties	the unit: R ngth of intervoof measurab	teal No's vals, Ope le sets.	& measura en and close	ble sets d sets on real line	, Outer and inner					
Un	iit-2 Numb	per of lectures =08	Title of	the unit: co	onvergen	ce & unifor	m convergence						
	Sequence and Se M test, Abel's an	ries of functions, pointw d Dirichlet's test, for uni	vise and uniform co	onvergence, and differen	Cauchy o tiation, u	criterion for miform con	uniform converg vergence and integ	ence, Weierstrass gration.					
Un	Number of lectures = 08Title of the unit: Reimann Stieltjes integral & properties												

	Weierstrass approximation theorem, The fundamental theorem uniform convergence, Properties and some important theorem.	orem of ems on I	integra Reimar	ıl calcul ın Stielt	us, Defi jes integ	nition a gral.	nd exis	stence o	f Pointv	vise and
Unit-4	Number of lectures = 08 Title of	f the un	nit: Po	wer serie	es					
	Power series, uniqueness theorem of power series, Abel's a Riemann's theorem.	and Tayl	or's the	eorem, H	Rearrang	gement o	of terms	s of seri	es &	
Unit-5	Number of lectures = 08 Title of	f the un	it: Par	tial and	Total d	ifferenti	ations			
	Partial derivatives, Total derivative, Jacobian, Chain rule, function theorem, implicit function, functions of several va	interchar triables &	nge of 1 & linea	the orde ar transfo	r of diff ormatio	èrentiat n.	ion, hig	her der	ivatives,	inverse
	11. CO-PO mapping									
COs	Attributes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Students will gain an understanding of countability of Lebesgue measure on the real line, Length of intervals, of closed sets on real line. They will also learn about outer an Lebesgue measure, Lebesgue measurable sets and prope measurable sets.	of Sets, pen and nd inner erties of	3	2	1	1	1	2	2	2
CO2	Students will be able to understand Sequence and Se functions, Pointwise and uniform convergence, Cauchy c for uniform convergence. They will learn to define Abe Dirichlet's test, for uniform convergence and differen Uniform convergence and integration & Weierstrass M tes	eries of riterion el's and ntiation, t.	3	1	1	1	1	1	2	2
CO3	Students will create the own understanding of Wei approximation theorem, The fundamental theorem of calculus. They will define existence of Pointwise and u convergence, Properties and some important theore Reimann Stieltjes integral.	erstrass integral uniform ms on	3	1	1	1	1	2	2	2
CO4	Students will be able to understand about Power seri Uniqueness theorem of power series. They will also learr Riemann's theorem, Abel's, Taylor's theorem & Rearran of terms of series.	ies and 1 about. gement	3	1	1	1	1	2	2	2
CO5	Students will create the own understanding of partial derivatives. They will learn about Jacobian, function theorem and implicit function. Students will also to define chain rule, interchange of the order of differentiat higher derivatives.	ivatives inverse be able ation &	3	1	1	1	1	2	2	2
	3 Strong contribution, 2 Ave	erage con	ntributi	on , 1 L	ow cont	ribution	l		1	<u> </u>
	12. Brief description of self learning / E-learning comp	onent								
	1. https://www.youtube.com/watch?v=Xx7ULr79fy0&lis2. https://www.youtube.com/watch?v=Xx7ULr79fy0&lis3. h https://www.youtube.com/watch?v=AqHxSRul-Ck	t <u>=PLbM</u> t=PLbM	IVogVj IVogVj	5nJSxF 5nJSxF	ihV-ec4 ihV-ec4	<u>A3z_F(</u> A3z_F(	DGPRC DGPRC	o-&ind	ex=4 ex=4	
	<ul> <li>13. Books recommended:</li> <li>Books Recommended:</li> <li>1. W. Rudin: Principle of Mathematics Analysis</li> <li>2. D. Somasundram and B. Choudhary: A First Course in N</li> <li>3. S. C. Malik: Mathematical Analysis, Wiley Eastern, Indi</li> <li>4. Jain, P.K. &amp; Gupta V.P., Lebesgue measure and Integrat</li> </ul>	Mathema ia. tion, Wil	ntical A lley Eas	nalysis, stern Ltc	Narosa l., New	, 1999. Age Int	. Ltd., 1	New De	lhi, (199	94).

1.	Name of th	e Department:	Mathematics and Statistics									
2.	Course Na	me	Modern Algebra			L		Т		F	)	
3.	<b>Course Co</b>	de	MT407			3		1		0	)	
4.	Type of Co	ourse (use tick	mark)	Core (✔)	DSE ()	AEC ()	SEC	0	0	E ()		
5.	Pre-requis (if any)	ite	B.Sc. with Mathematics as a major subject.	6. Frequency (use tick	Even ()	Odd (✓)	Eithe	er Sem ()	Ev	very S	em (	С
7.	Total Num	ber of Lecture	s, Tutorials			1						
Lec	ctures = 30			Tutorials = 10		Practical =	Nil					
8. C	OURSE OB	JECTIVES: T	he objective is to discuss the ba	asic concept to cert	ain classes	of groups and	d rings.	The cour	se dea	als wit	th the	•
some math	e algebraic st ematical ma	tructures, their p turity and enabl	properties and some of the basic les to build mathematical think	c results related to ing and skill.	group and r	ring theory. N	/lodern	algebra g	ives to	o stud	ent a	good
9. C	OURSE OU	TCOMES (CC	<b>)</b> ):									
After	the success	ful course com	pletion, learners will develop j	following attribute	s:							
coι	RSE OUT	COME (CO)	ATTRIBUTES									
CO1			Students will be able to explain	n the fundamental	concept of (	Certain classe	es of gr	oups.				
CO2			Students will be able to descril	be Sylow's theorem	n and their a	applications.						
CO3			Students will be an understand	ling of ideals and q	uotient of r	ings.						
CO4			Students will be able to descril	be integral domains	s and divisi	bility in integ	gral don	nains.				
C05			Students will be able to explain	n fields, splitting fi	elds and fie	ld extensions	5.					
10.	Unit wise d	etailed content	,									
Uni	it-1		Number of lectures = 08	Title of the un	it:							
Norn	nal subgroup	s and Quotient	groups, Permutation groups, H	Iomomorphisms, C	ayley's the	orem.						
Uni	it-2		Number of lectures =08	Title of the uni	t:							
Conj	ugate eleme	nts, Class equat	ion, Cauchy theorem, Sylow's	theorems and its A	pplications							
Uni	it-3		Number of lectures = 08	Title of the uni	t:							
Quot	ient of rings	, Maximal and <sub>J</sub>	prime ideals, Homomorphisms	, Polynomial rings.								
Uni	it-4		Number of lectures = 08	Title of the uni	t:							
Integ Poly	ral domain, nomial ring	Divisibility in i s over UFD.	ntegral domains, Unique factor	rization domains, P	rincipal ide	al domains, l	Euclide	an domai	ns,			
Uni	it-5		Number of lectures = 08	Title of the unit	t:							
Field	s, Extensior	of fields, Splitt	ting fields, Algebraic extension	ns of fields: Irreduc	ible and rec	lucible polyn	omials					
11. (	CO-PO map	ping										
COs		Attributes				PO1	PO2	PO3 PO4	PO5	PO6	PO7	7 <u>PO</u>
C01		Students will be groups.	e able to explain the fundament	tal concept of Certa	ain classes o	of 3	2	1 2	3	1	3	3
CO2		Students will be	e able to describe Sylow's theo	rem and their appli	ications.	3	2	1 2	3	1	3	2
СО3		Students will be	e an understanding of ideals and	d quotient of rings.		3	2	1 2	3	1	2	3
CO4		Students will be domains.	e able to describe integral doma	ains and divisibility	y in integral	3	1 1	1 2	2	1	3	2
C05		Students will be	e able to explain fields, splitting	g fields and field ex	xtensions.	3	1	1 2	2	1	2	3
3 Str	ong contribu	tion, 2 Average	e contribution, 1 Low contribu	tion		•		•				
12.	Brief descr	iption of self le	arning / E-learning compone	nt								
1.	https://npte	l.ac.in/courses/1	111/105/111105112/									
2.	https://npte	l.ac.in/courses/1	<u>111/106/111106131/</u>									
3. 13	Books reco	mmended.	111/103/111103112/									
13.	1. I. N. He	rstein: Topics in	n Algebra, Wiley Eastern Ltd									
,	2. Joseph	A. Gallian: Con	temporary Abstract Algebra, N	arosa Publishing H	Iouse.							
	3. Surjeet	Singh and Qazi	Zameeruddin: Mordern Algebr	ra, Vikas Publishin	g House.							

2. Course Name	C	Ordinary Differentia	l Equ	ntions		L	Т	Р
3. Course Code	I	MT408				3	1	0
4. Type of Course (us	se tick ma	rk)	Cor	·e (□)	DSE ()	AEC ()	SEC ()	<b>OE</b> ()
5. Pre-requisite (if any)	B	B.Sc (Mathematics)	6.	Frequency (use tick marks)	Even (□)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of L	ectures, T	Futorials, Practicals			I	1		
Lectures = 30			Tut	orials = 10		Practical =	- Nil	
8. COURSE OBJECT towards the construction	<b>IVES:</b> To and solut	o put it briefly, the p tion of mathematical	oint o models	f this class is s in the form o	to take yo of differenti	our existing al equations	knowledge of calo	culus and apply
. COURSE OUTCOM	ES (CO):					1		
fter the successful cour	se comple	etion, learners will de	velop.	following attr	ributes:			
COURSE OUTCOM	E (CO)	ATTRIBUTES						
C01		Student will be able the student of	to find `the co	the complete mplementary	e solution o function ar	f a non hom id a particula	nogeneous differen ar solution.	tial equation as
CO2		Student will be introd constant coefficients l	luced t by the	o the complet method of un	e solution of determined	of a non hom coefficients	nogeneous differen	tial equation wit
CO3		Students will be able	to Use	power series	to solve fir	st-order and	second-order diffe	rential equation
CO4		Successful students in about and will be able	n Bour e to an	ndary Value P alyze solution	Problems an s to two-po	d Differenti int boundary	al Equations will b value problems	e knowledgeab
CO5		Students will gain an	unders	standing of Sta	ability of d	namical sys	tems	
10. Unit wise detailed of	content							
Unit-1 in son differential aquati	Number	$\cdot$ of lectures = 08		le of the uni	it: Topolog	gical spaces	theorem on line	an danandanaa
olutions, adjoint, self ad	joint linea	r operator, Green's fo	rmula	. solutions, w	TOHSKIAH A	bei s identit	y, meorem on me	ar dependence
Unit-2	Number	of lectures =08	Titl	e of the unit	t: Homeon	orphism ai	nd separation axio	oms
Adjoint equations, the	nth order	non homogeneous li	near e	quations, Var	iation of p	arameters, z	eros of solutions,	comparison and
Unit-3	Number	of lectures = 08	Titl	e of the unit	t: Compac	tness		
ower series, solution of	linear dif	ferential equations, or	rdinary	v and singular	· points of c	lifferential e	quations. Classific	ation into regul
nd irregular singular poi	nts, series	solution about an ord	linary	point and regu	ular singula	r point.		anon nico regan
Unit-4	Number	of lectures = 08	Titl	e of the unit	t: Connect	edness		
xistence and uniquenes	s of solut	ions: Lipschitz Cond	ition,	Successive A	pproximati	on, Picard's	theorem for initi	al value probler
Iomogeneous BVP, Nor	n-Homoge	eneous BVP, Sturm	Liouv	ille's problem	n, Green's	function, n	on-existence of sc	lutions, Picard
heorem for BVP.	1							
Unit_5	Number	r of lootures — AQ	1 1 1 1 4 4	a of the unit	• Product '	L'onology		

11. СО-Р	O mapping								
COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8
CO1	3	1	1		1	1	1	2	
CO2	Student will be introduced to the complete solution of a non homogeneous differential equation with constant coefficients by the method of undetermined coefficients.	3	1	2		3	1	1	2
CO3	Students will be able to Use power series to solve first-order and second-order differential equations.	3	1	2		3	1	1	2
CO4	Successful students in Boundary Value Problems and Differential Equations will be knowledgeable about and will be able to analyze solutions to two-point boundary value problems	3	1	1		3	1	1	3
CO5	Students will gain an understanding of Stability of dynamical systems	3	1	1		2	2	1	3
	3 Strong contribution, 2 Average contribution	, 1 Lov	v contri	oution					
12. Brie	f description of self learning / E-learning component								
1. <u>http</u> 2. <u>http</u> 3. <u>http</u>	s://ocw.mit.edu/courses/mathematics/18-03-differential-equations-sprin s://nptel.ac.in/courses/111/106/111106100/ ://www.math.iitb.ac.in/~siva/afs07.pdf	ng-2010	)/video-	lectures	<u>;/</u>				
<b>13.</b> Bool 1. M. D. 2. M. D. 3. P. Hait 4. E.A. C	<b>ks recommended:</b> Rai Singhania, Advance differential equations – S. Chand , 1995. Rai Singhania, Ordinary differential equations – S. Chand . tman: Ordinary Differential Equations, Wiley, New York, 1964. 'oddington and H. Davinson: Theory of Ordinary Differential Equations	s, McG	raw Hil	l, NY, 1	955.				

	1. Name	of the Department: Mat	hematics and Statistic	es						
2. Cour	rse Name	Discrete Mathema	tics			L	Т	Р		
3. Cour	rse Code	MT409				3	1	0		
4. Туре	e of Course	(use tick mark)	Core (?)	DSE ()		AEC ()	SEC ()	<b>OE</b> ()		
5. Pre-i (if a	requisite ny)	B. Sc. with Mathematics	6. Frequency (use tick marks)	Even ()		Odd (?)	Either Sem ()	Every Sem ()		
	7. Total	Number of Lectures, Tut	orials, Practicals	1						
Lectures	= 30		Tutorials = 10			Practical =	Nil			
	<ol> <li>COURS</li> <li>The cours</li> <li>The cours</li> <li>The cours</li> <li>COURS</li> <li>After the su</li> </ol>	E OBJECTIVES: 1. To fa se will help the student to u se will also develop an und se will further develop und E OUTCOMES (CO): uccessful course completio	amiliarize students wit understand proposition erstanding of the elem erstanding of graphs &	h various con as and their tra- ents of Boole & trees with it	ts applic	f Discrete m les. bra and its v cations.	athematics. arious aspects.			
COL	JRSE	ATTRIBUTES	n, icumers with acven	p jouowing (	umon					
CO1       Students will gain an understanding of Statements, connectives, Truth tables, Tautologies & Contradiction Equivalences & Implications. They will be able to understand and implement Normal forms. along will Quantifier, Predicates, Posets & Lattices and also about Lattices on Algebraic systems, Sub-lattices. Understand the formation of Hasse diagram.										
CO2 Students will be able to understand Boolean identities, the switching algebra, sub-algebra, Direct product homomorphism. Boolean forms & their equivalences. They will learn to form Sum of products & Product of su form, Normal form, Canonical form, Boolean expression & Boolean functions with the help of Karnaugh r method.										
C	03	Students will create th about Recurrence relat	e own understanding o ion and also about the	of Permutatio ir solution by	ns & co / charac	mbinations, teristic roots	Pigeon hole princ and Generating f	iple. They will learn unction.		
C	04	Students will be able graphs. They will also be able to know about their formation by Kru	to understand degree of learn about representa Trees, Binary tree, th iskal's algorithm.	of a vertex di ation of graph eir types and	fferent t ns with t l their p	types of gray the help of n roperties. Th	phs including Eulonatrix. and Graph hey also learn abo	erian & Hamiltonian colouring. They will ut spanning tree and		
C	05	Students will create th learn about Paths & co Classification, their ty	ne own understanding onnectivity, composition pes & their composition	of relations a on of relation on, growth of	and thei is. Stude functio	r representa ents will also ns, Recursiv	tion by matrix & b be able to under re function.	Digraph. They will stand Function, their		
	10. Unit v	vise detailed content								
Unit-1		Number of lectures = 08	Title of	the unit: M	Iathema	tical logic &	Lattices			
	Statement: Predicates	s, connectives, Truth table . Posets & Lattices, Hasse	s, Tautologies & Cont diagram, Lattices on A	radictions. Eo	quivaler tems, Sı	ices & Impl ib-lattices.	ications. Normal 1	forms, Quantifier &		
Unit-2	1	Number of lectures =08	Title of	the unit: Bo	oolean A	Algebra				
	Boolean id Sum of p Karnaugh	dentities, the switching alg products & Product of su map method.	gebra, sub-algebra, Dir ms form, Normal for	ect product d rm, Canonica	& homo al form	omorphism. , Boolean o	Boolean forms & expression & Boo	their equivalences. blean functions-the		
Unit-3	. 1	Number of lectures = 08	Title of	the unit: Co	mbinato	orics				
	Permutatio	ons & combinations, Pigeo	n hole principle, Recu	rrence relatio	n, solut	ion by chara	cteristic roots, Ge	nerating function.		
Unit-4		Number of lectures = 08	Title of	the unit: Gr	aphs &	Trees				
	Degree of a vertex, types of graphs, Eulerian & Hamiltonian graphs, Matrix representation of graphs, Graph colouring. Trees: Properties, spanning tree, Kruskal's algorithm, Binary tree, tree reversal.									

Unit-5	Number of lectures = 08Title of the unit: Relation	n & Fur	nctions						
	Properties, matrix & Digraph representation of relation, Paths & connectivity,	, comp	osition	of rela	ations.	. Func	ctions:	Classi	fication,
	types & composition of functions, growth of functions, Recursive function.								
	11. CO-PO mapping					-			
COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
C01	Students will gain an understanding of Statements, connectives, Truth tables, Tautologies & Contradictions, Equivalences & Implications. They will be able to understand and implement Normal forms. along with Quantifier, Predicates, Posets & Lattices and also about Lattices on Algebraic systems, Sub-lattices. Understand the formation of Hasse diagram.	3	2	1	1	1	2	2	2
CO2	Students will be able to understand Boolean identities, the switching algebra, sub-algebra, Direct product & homomorphism. Boolean forms & their equivalences. They will learn to form Sum of products & Product of sums form, Normal form, Canonical form, Boolean expression & Boolean functions with the help of Karnaugh map method.	1	1	1	1	1	2	2	
CO3	Students will create the own understanding of Permutations & combinations, Pigeon hole principle. They will learn about Recurrence relation and also about their solution by characteristic roots and Generating function.	3	1	1	1	1	2	2	2
CO4	Students will be able to understand degree of a vertex different types of graphs including Eulerian & Hamiltonian graphs. They will also learn about representation of graphs with the help of matrix. and Graph colouring. They will be able to know about Trees, Binary tree, their types and their properties. They also learn about spanning tree and their formation by Kruskal's algorithm	3	1	1	1	1	2	2	2
CO5	Students will create the own understanding of relations and their representation by matrix & Digraph. They will learn about Paths & connectivity, composition of relations. Students will also be able to understand Function, their Classification, their types & their composition, growth of functions, Recursive function.	3	1	1	1	1	2	2	2
	3 Strong contribution, 2 Average contribution	, 1 Lov	v contr	ibutior	1				
	12. Brief description of self learning / E-learning component								
	<ol> <li>https://freevideolectures.com/course/3517/discrete-mathematics</li> <li>http://home.iitk.ac.in/~arlal/book/mth202.pdf</li> <li>https://www.cis.upenn.edu/~jean/discmath-root-b.pdf</li> </ol>								
	<ul> <li>13. Books recommended:</li> <li>1. Elements of Discrete Mathematics, C.L.Liu, Tata McGraw-Hill Publishing</li> <li>2. Discrete Mathematical Structures, Kolman, Busby &amp; Ross, 4e, Prentice Ha</li> <li>3. Discrete Mathematics with Graph theory, Goodaire &amp; Parmenter, 2e, Pears</li> <li>4. Discrete Mathematical Structures, J.P.Tremblay &amp; R.Manohar, McGraw-H</li> </ul>	Comp Il of In on. Iill Boc	any Lto dia. ok co.	d, New	v Delh	i.			

1. Nan	ne of the Depart	ment: Mathema	tics									]
2. Cou	rse Name	Comple	x Analysis			L		]	[		Р	
3. Cou	rse Code	MT410				3		]	l		0	
4. Typ	e of Course (use	tick mark)		Core (✓)	DSE ()	AEC (	)	SEC ()		OE	0	
5. Pre- (if a	-requisite any)	B.Sc. wi	th Maths	6. Frequency (use tick	Even ()	Odd (v	()	Either	Sem ()	Eve	ry Ser	n ()
7. Tota	al Number of Le	ctures, Tutorial	S							1		
Lecture	s = 30	•		Tutorials = 10		Practica	al = N	lil				
8. COU using the successf	<b>RSE OBJECTI</b> e principal of pu ully completion c	<b>VES:</b> The purpo are and applied n of course, the stud	se of this postg nathematics to dent will able e	graduate course is t obtain quantitative xplore subject into	to impart bar relations we their respec	sic and l hich are tive dime	key k very ensior	nowledg importa 1s	ge of con nt for hi	nplex gher s	analy tudies	sis. By . After
9. COUR	SE OUTCOME	S (CO):			•							
After the	successful cours	e completion, lea	irners will deve	elop following attri	butes:							
	CO1	Find an potentia	nd interpret An al, Cauchy Integ	nalytic functions, gral Theorem and C	Cauchy Ric Cauchy integ	emann E gral form	Equati ula	ons, Ha	armonic	functi	on, v	elocity
	CO2	Evaluat function of power	te and Interpre ns, Laurent's se er series.	t the Power series eries,Integration and	, Uniform d differentia	converge ation of p	ence, oower	Taylor' series,	s series, multiplic	zeros ation	of a and d	nalytic ivision
	CO3       Describe and evaluate the Cauchy residue theorem, evaluation of real definite integration when function has no pole on real axis and pole lies on real axis, Integral involving many valued function, contours											
	CO4	State an and Sch	nd explain Con 1warz,-Christof	formal bilinear exp fel transformations	oonential an	d trigono	ometri	ic transf	formation	ns, spe	cial b	ilinear
	CO5	State a Picard'	nd explain the s theorem, Jens	Weierstrass's the en inequality and fo	orem, princ ormula, Hao	iple of 1 lamard's	maxin three	num m circle t	odulus, S heorem a	Schwa ind as	rz's l a con	emma, vexity
10. Unit	wise detailed co	ontent										
Unit-1		Number of lect	tures = 08	Title of the uni	t:							
Analytic Theorem	functions, Cauch and Cauchy inte	hy Riemann Equ gral formula	uations, Harmo	nic function, veloc	ity potentia	l, Milne	's Tha	aomson	method,	Cauc	hy In	tegral
Unit-2		Number of lect	tures =08	Title of the unit	t <b>:</b>		<b>T</b> .		1 1:00		6	
Power ser series, mu	ltiplication and d	ivision of power	r's series, zeros series	s of analytic function	ons, Laurent	t's series,	Integ	ration a	nd differ	entiati	on of	power
Unit-3		Number of lect	tures = 08	Title of the unit	t <b>:</b>							
Cauchy re involving	esidue theorem, e many valued fun	valuation of real ction, rectangula	definite integra r contours	tion when function	has no pole	e on real	axis a	and pole	e lies on	real ax	xis, In	tegral
Unit-4		Number of lect	tures = 08	Title of the unit	t:							
Conforma	l bilinear expone	ntial and trigono	metric transform	mations, special bil	inear and So	chwarz,-0	Christ	offel tra	nsforma	tions.		
Unit-5		Number of lec	tures = 08	Title of the unit	•							
Weierstra three circl	ss's theorem, prin le theorem and as	nciple of maximu a convexity	um modulus, So	chwarz's lemma, P	icard's theo	rem, Jen	sen in	equality	y and for	mula,	Hada	mard's
11. CO-P	O mapping											
COs			Attributes			PO1	PO2	PO3 P	04 PO5	PO6	PO7	<b>PO8</b>
CO1	Find and interpr function, veloci	ret Analytic fun ty potential, Ca	ctions, Cauchy auchy Integral	Riemann Equation Theorem and Ca	ons, Harmo luchy integ	nic gral 3	2	2	1 2	1	1	3

CO2	Evaluate and Interpret the Power series, Uniform convergence, Taylor's series, zeros of analytic functions, Laurent's series, Integration and differentiation of power series, multiplication and division of power series.	2	2	2	1	2	1	2	3
CO3	Describe and evaluate the Cauchy residue theorem, evaluation of real definite integration when function has no pole on real axis and pole lies on real axis, Integral involving many valued function, contours	3	3	1	1	2	2	1	3
CO4	State and explain Conformal bilinear exponential and trigonometric transformations, special bilinear and Schwarz,-Christoffel transformations	3	2	3	1	1	1	1	3
C05	State and explain the Weierstrass's theorem, principle of maximum modulus, Schwarz's lemma, Picard's theorem, Jensen inequality and formula, Hadamard's	3	2	1	2	1	1	3	3
	3 Strong contribution, 2 Average contribution, 1 Low co	ntrib	ution						
12. Brie	ef description of self learning / E-learning component								
1. <u>http</u>	p://www.bhojvirtualuniversity.com/slm/mscmath1p4.pdf								
2. <u>http</u>	p://web.math.ku.dk/noter/filer/koman-12.pdf								
3. <u>http</u>	os://www.youtube.com/watch?v=YORGYJKDDN0								
13. Boo	oks recommended:								
1. L.V.A	lforse, Complex Analysis, McGraw-Hill Book Company								
2 B Cha	audhary. The elements of Complex Analysis. Wiley Fastern								

2. B. Chaudhary, The elements of Complex Analysis, Wiley Eastern

3. Shanti Narayan, Theory of Functions of a complex variable, S. Chand & Co.

1.	Name of the	<b>Department: Mathematics</b>										
2.	Course	Statistical Techniques			L	Т	Р					
3.	Course	MT411			3	1	0					
4.	Type of Cou	rse (use tick mark)	Core (✓)	DSE (	) <b>AEC</b> ()	SEC ()	<b>OE</b> ()					
5.	Pre-		6. Frequency (use	Even (	) Odd (✓)	Either Sem ()	Every Sem ()					
	requisite		tick marks)									
7.	Total Numbe	er of Lectures, Tutorials										
Le	Lectures = 30 Tutorials = 10 Practical = Nil											
0	9 COUDEE ODIECTIVES. To took the hair and to do not be determined to determine the billion dependent of the other. This is											

**8. COURSE OBJECTIVES:** To teach the basic concepts used to describe data. Probability theory and testing of hypothesis. This is a great beginner course for those interested in Data Science, Economics, Psychology, Machine Learning, Sports analytics and just about any other related field.

**9. COURSE OUTCOMES (CO):** 

*After the successful course completion, learners will develop following attributes:* 

COURSE OUTCOME (CO)	ATTRIBUTES
C01	Understand of data, scales of measurement, presentation of data with the help of diagrams and graphs.
CO2	Description of data through its central value, variability and shape.
CO3	Understanding of bi-variate data, degree of its relationship and functional relationship between variables. Prediction of future values.
CO4	Explain the concept of weighted and unweighted index numbers, its applications to real life. Consumer Index number.
CO5	Understand the theory of attributes. Contingency tables, class frequencies and ultimate class frequencies, consistency of attributes, association of attributes, independence of
10. Unit wise detailed content	
Unit-1 Number of lectures = (	06 Title of the unit:

Discrete and continuous data, Frequency and non-frequency data, primary and secondary data, diagrammatic and graphical representation of grouped data, frequency and cumulative frequency distribution and their applications, histogram, frequency polygon, ogives. Concept of central tendency and its measures, partition values, dispersion and relative dispersion, moments, Sheppard's

Unit-2 Number of lectures =06 Title of the unit:

Scatter diagram, Karl Pearson's and spearman's rank correlation coefficients, coefficient of determination, correlation ratio, principle of least squares, fitting of linear regression and related results, partial and multiple correlations of three variables, their measures and related results.

Unit-3 Number of lectures = 06 Title of the unit:

Random experiment, trial, sample point, sample space, definitions of equally likely, mutually exclusive and exhaustive events, definition of probability, classical, relative frequency and axiomatic approaches to probability, conditional probability, independence of events, Bayes theorem and its applications.

Unit-4 Number of lectures = 06 Title of the unit:

Discrete and continuous random variable, expectation and variance of random variables, Probability mass/ density function, distribution function, joint density function of two continuous variables, marginal and conditional probability density functions, uniform, binomial, Poisson, geometric, negative binomial, hyper geometric and normal distributions.

Unit-5 Number of lectures = 06 Title of the unit:

null and alternative hypotheses, critical region, types of error, level of significance, p-value, size and power of a test, Z, t, chi-square & F tests, analysis of variance: one way and two way classifications.

## 11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
C01	Understand of data, scales of measurement, presentation of data with the help of diagrams and graph, central values and variability of data.	3	2	1	2	1	1	3	3
CO2	Understanding the correlation and regression and forecasting of data values	3	1	2	1	2	1	2	3
CO3	Understand the concept of probability, prior and posterior probabilities.	3	2	1	1	2	1	3	3
CO4	Understand and apply special distribution functions of probability in real life situation.	3	2	2	1	2	1	2	3
CO5	Understand and apply various tests for testing hypothesis.	3	2	1	2	2	1	2	3

3 Strong contribution, 2 Average contribution, 1 Low contribution

## 12. Brief description of self learning / E-learning component

- 1. https://www.youtube.com/watch?v=PWbOq-Inmck
- 2. https://www.youtube.com/watch?v=KIBZUk39ncI
- 3. https://www.youtube.com/watch?v=jBQCwbHfKoM
- 4. https://www.youtube.com/channel/UCGT0pirandEMtvu-3JwePSw
- 5. https://www.youtube.com/watch?v=xTpHD5WLuoA
- 6. https://www.youtube.com/watch?v=KOEEZn2xR3k&list=PLOoogDtEDyvvw5bIV77qibe73XfdsM2lP
- 7. https://www.youtube.com/watch?v=L0zWnBrjhng
- 8. https://www.youtube.com/watch?v=SrEmzdOT65s
- 9. https://www.youtube.com/watch?v=HpWpIY2fhIo

## **Recommended Books:**

- 1. Spiegel M.R. (1967): Theory and problem of Statistics, Schaum's Publishing Series.
- 2. Goon A.M., Gupta M.K. and Das Gupta B. (1991): Fundamental of Statistics, Vol. I, World Press, Calcutta.
- 3. Meyer P.L. (1970): Introductory Probability and Statistical Applications, Addision Wesley.
- 4. Hogg R.V. and Craig A.T. (1972): Introduction to mathematical Statistics, Amerind Publishing Co.
- 5. Rohtagi, V.K. (1967): An Introduction to Probability and Statistics, Wiley Series in Probability and Statistics.