Name of the Faculty: Faculty of Science

Name of the Program: B.Sc. (Non-Medical)

Batch: 2021-2022 onwards

Program Structure as per NEP 2020

Semester	Core Course (CC)	Discipline Specific Elective (DSE)	Multidiscip -linary Generic Elective (MGE)	Ability Enhancement Compulsory Courses (AECC)	Skill Enhancemen t Courses (SEC)	Value Addition Courses (VAC)	Project	Total Credits	Total Contac Hours
I	CC-1 (5) CC-2 (5) CC-3 (5)		MGE-1(4)	AECC -1 (2)		VAC-1 (2)	· · · ·	23	29
II	CC-4 (5) CC-5 (5) CC-6 (5)		MGE-2(4)	AECC -2 (2)		VAC-2 (2)		23	29
	Pro	vision to prov	ide Certificate	Course in Basic S	sciences		Total	46	58
Ш	CC-7 (5) CC- 8(5) CC- 9 (5)		MGE-3(4)	AECC -3 (2)		VAC-3 (2)		23	29
IV	CC- 10(5) CC- 11(5) CC- 12(5)		MGE-4(4)	AECC -4 (2)		VAC-4 (2)		23	29
		Provision to	provide Diplo	ma in Basic Science	es		Total	92	58
v		DSE-1 (6) DSE-2 (6) DSE-3 (6)			SEC-1 (3)			21	27
VI		DSE-4 (6) DSE-5 (6) DSE-6 (6)			SEC-2 (3)			21	27
1	I.	BS	c (NM) will be	awarded			Total	134	112
VII	-	DSE-7 (6) DSE-8 (6)	2				8	20	32
VIII		DSE-9 (6) DSE-10(6)					8	20	32
	BSc (NM)	with Researc	h (Phy /Chem	/Maths /EVS) will	be awarded		Total	174	176

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Muthidisinimary Ganaria Elective AMCEL1 | Value Added Course NACI-1 | . (A) Annual manual manual | Environmental Science | Electricity, Magnetism and EMT | Electricity, Magnetism and EMT Lab | General Organic Chemistry and Introduction to Organic Functional Groups
 | General Organic Chemistry and Introduction to Organic Functional Groups Lab | Differential Equations | Differential Equations Lab | Multidisiplinary Genereic Elective (MGE)-2 | Value Added Course (VAC)-2
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84		17030621	Chemistry of Main Group Elements, Theories of Acids and Bases Lab	Practical	DSE	0	0	4	2						20	20	40	16	10	10	10	30	60 :	24	100	40
85		17030622	Integral Transformation	Theory	DSE	4	0	0	4	60 2	4 20	10	10	40 16					2003				-		100	40
86		17030623	Integral Transformation Lab	Practical	DSE	0	0	4	2						20	20	40	16	10	10	10	30	60	24	100	40
87		17030624	Partial Differential Equations	Theory	DSE	4	0	0	4	60 2	4 20	10	10	40 16										-	100	40
88		17030625	Partial Differential Equations Lab	Practical	DSE .	0	0	4	2	10					20	20	40	16	10	10	10	30	60 2	24	100	40
89		17030626	Numerical Methods	Theory	DSE	4	0	0	4	60 2	4 20	10	10	40 16		-		-					-	-	100	40
90		17030627	Numerical Methods Lab	Practical	DSE	0	0	4	2						20	20	40	16	10	10	10	30	60	24	100	40
																								-		-
91		17030701	Mathematical and Computational Physics	Theory	DSE	4	0	0	4	60 2	4 20	10	10	40 16				-					-	-	100	40
92		17030702	Physics Practical-1	Practical	DSE	0	0	4	2		1	1			20	20	40	16	10	10	10	30	60	24	100	40
93		17030703		Theory	DSE	4	0	0	4	60 2	4 20	10	10	40 16			10				10				100	40
94		17030704	Physics Practical-2	Practical	DSE	0	0	4	2		-	1			20	20	40	16	10	10	10	30	60	24	100	40
95		17030705	Quantum Chemistry and Thermodynamics	Theory	DSE	4	0	0	4	60 2	4 20	10	10	40 16	1 20	1			10		10				100	10
96		17030706	Physical Chemistry Practical-I	Practical	DSE	0	0	4	2		120	1			20	20	40	16	10	10	10	30	60	24	100	40
97	-	17030707	Stereo Chemistry and Organic Reaction Mechanism	Theory	DSE	1	0	0	4	60 2	1 20	10	10	10 16	20	20	40		10	10	10				100	40
98		17030709	Organic Chemistry Practical-I	Practical	DSE	1	0	4	2	00 2	120	10		+0 10	20	20	10	16	10	10	10	20	-	24	100	10
99		17030708	Metric Space	Theory	DSE		0	-	-	000	1 20	10	10	10 10	20	20	40	10	10	10	10	30	00 4	24	100	40
10	VIIIV	17030709	Functional Analaysis	Theony	DSE	4	0	0	4	60 2	4 20	10	10	40 10		-		-		-			-+	-	100	+0
10		17030710	Advanced Differential Equations	Theory	DOE	4	0	0	4	00 2	4 20	10	10	40 10		-		-		-			-	+	100 4	+0
10	-	17030711	Advanced Differential Equations	Dreatical	DOE	4	0	-	4	00 2	4 20	10	10	40 10	00	00	10	-	10	-				-	100	+0
10		1/030/12		Theorem	DOE	0	0	4	2	-	1	10	10		20	20	40	16	10	10	10	30	60 2	24	100	40
10		17030713	Ecology and Biodiversity	Desetient	DSE	4	0	0	4 1	60 2	4 20	10	10	40 16	-	-		-		-			-		100	40
10		17030714	Air and Maine Dellution	Practical	DSE	0	0	4	2			1	-	-	20	20	40	16	10	10	10	30	60 2	24	100	40
10	2	17030715	Air and Noise Pollution	Theory	DSE	4	0	0	4 1	60 2	4 20	10	10	40 16		-		-		_			-		100	40
100	2	17030716	Air and Noise Pollution-Lab	Practical	DSE	0	0	4	2	1 1	1	13	19		20	20	40	16	10	10	10	30	60 2	24	100	40
10.	4	17030717	Project - I	Practical	DSE	0	0	8	8	1	1	1	194	-	40	40	80	32	20	20	20	60 1	120	48	200	30
108	빅		PYTHON Lab	Practical	DSE	0	0	4	2	1	5	0.4	100	-	20	20	40	16	10	10	10	30	60 2	24	100	40
-							_	_	-	1				-					1	-						_
109	2	17030801	Advanced Quantum Mechanics	Theory	DSE	4	0	0	4 1	60 24	4 20	10	10	40 16										-	100	40
110	2	17030802	Physics Practical-3	Practical	DSE	0	0	4	2	-	1	14	1		20	20	40	16	10	10	10	30	60 2	24	100	40
11	1	17030803	Physics of Nanomaterials	Theory	DSE	4	0	0	4 (60 24	4 20	10	10	40 16				-							100	40
112	2	17030804	Physics Practical-4	Practical	DSE	0	0	4	2			1	19.		20	20	40	16	10	10	10	30	60 2	24	100	40
113	3	17030805	Transition Metal Chemistry	Theory	DSE	4	0	0	4 (60 24	4 20	10	10	10 16											100	40
114	1	17030806	Inorganic Chemistry Practical-I	Practical	DSE	0	0	4	2	13.1	5 2.00	1	11	12	20	20	40	16	10	10	10	30	60 2	24	100	40
115	5	17030807	Instrumental Techniques	Theory	DSE	4	0	0	4 (60 24	4 20	10	10	10 16									-		100	40
116	5	17030808	Instrumental Techniques Lab	Practical	DSE	0	0	4	2		ant.	1	121		20	20	40	16	10	10	10	30	60 2	24	100	40
117		17030809	Analysis-II	Theory	DSE	4	0	0	4 6	60 24	1 20	10	10	10 16										T	100	40
118	3	17030810	Algebra-II	Theory	DSE	4	0	0	4 6	60 24	1 20	10	10	10 16	1.										100	40
119	9	17030811	Mathematical Programming	Theory	DSE	4	0	0	4 6	60 24	1 20	10	10	10 16	100										100	40
120		17030812	Mathematical Programming Lab	Practical	DSE	0	0	4	2	1	1		1	-	20	20	40	16	10	10	10	30	60 :	24	100	40
121	1	17030813	Soil and water Pollution	Theory	DSE	4	0	0	4 6	30 24	1 20	10	10	10 16										1	100	40
122	2	17030814	Soil and water Pollution-Lab	Practical	DSE	0	0	4	2			4	0		20	20	40	16	10	10	10	30	60 2	24	100	40
123	3	17030815	EIA and Sustainable development	Theory	DSE	4	0	0	4 6	30 24	1 20	10	10	10 16				1					-	1	100	40
124	1	17030816	EIA and Sustainable developmen-Lab	Practical	DSE	0	0	4	2		-				20	20	40	16	10	10	10	30	60 2	24	100	40
125	5	17030817	Project - II	Practical	DSE	0	0	8	8					-	40	40	80	32	20	20	20	60 1	120 4	48 :	200 1	80
126	3		LATEX Lab	Practical	DSE	0	0	4	2		1				20	20	40	16	10	10	10	30	60 :	24	100	40

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SEMESTER-I (CORE)



1 Nome of the D	anter Familte - CO					
1. IName of the Fa	English			Т	T	D
2. Course Name	English				1	P
4 Type of Course	(use tick mark)	Coro	DEE	4 CE O		0
4.1 ype of Course	(use lick mark)	Core ()	DSE O	GE ()	AEC (✓)	
5. Pre-requisite	10+2 with Science	6.	Even	$Odd(\checkmark)$	Fither	Every Sem
(if any)	stream	Frequency			Sem ()	
((use tick	U		Sem ()	0
4		marks)				
7. Total Number	of Lectures, Tutorials, Pra	acticals		I		
Lectures = 52		Tutorials =	Nil	Practical =	Nil	
8. Course Descri	ption:					
In this Ability E	nhancement Compulsory c	ourse, the stu	idents w	ill be able t	to know abo	out the basic
knowledge of Eng	lish Comprehension, Speech	hes with its te	rminolog	ies.		
9.Course Objecti	ves (COs):					
1. To learn ba	asics of English language					
2. To gain kn	owledge of English termino	logy and cond	ept			
3. To study th	ne concept of grammar and i	its appropriate	implicat	tions		
4 To enhance	e writing and communication	n skills	mpnea	lions		
	e mang and communicatio	11 SKIII5.				
10. Course Outco	omes (COs):					
Upon successful c	ompletion of this course, the	e students will	be able	to:		Q.
1. Know abou	ut the English Language					
2. Describe the	ne terminology and basics co	oncept of Eng	lish Gran	nmar.		
3. Improve w	riting skills, note making et	с.				
4. Apply the	concept of English language	in their writt	en and ve	erbal commu	nications.	
11. Unit wise deta	uiled content				5	
Unit-1	Number of lectures=13	Title of the	mit. Tie	toning Com	nuchanaian	
Speeches Intervie	audio-video clippings	followed by		stenning Com	tion to Com	munication
Importance of Cor	nmunication Barriers to Co	mmunication	and wave	s to overcom	e them	infuncation,
Unit – 2	Number of lectures=13	Title of the i	init: Cor	versation sl	zille	
		The of the t		iversation si	1115	
Greetings and Intr	oducing oneself, Framing qu	uestions and a	nswers,	Role play, B	uying: asking	details etc.,
Word formation s	strategies, Vocabulary build	ding: Antony	ms, Syn	onyms, Affi	xation, Suffi	xation, One
word substitution						
TI-::4 2	Number 61 4 40	701 (1) 6 (1)	•=			
Unit – 3	Number of lectures=13	Title of the u	init: R	keading Com	prehension	
Simple narration a	ing Stories, Newspaper and	articles clipp	ings, Sen	itence types,	Note Making	g, Paragraph
Writing, Comprehe	Number - flast 12	T:41. 6.1				
Unit – 4	Number of lectures=13	Title of the u	init: Wr	iting Compr	ehension	1 0 1
Topic contance	uppes, characteristics. Letter	rs: types, for	mat, styl	e, Precis Wi	riting, Paragi	raph: Order,
Pronunciation S-1	loble and Strage Interest	port and Pro	oposal, I	roject Writi	ng: Features	s, Structure.
12 Drief D	able and Stress, Intonation	and Modulatio	on			
12. Drief Descript	ton of sen-learning / E-lear	ZaDreful	nent			
1. <u>https://www</u>	w.youtube.com/watch?v=G	ZeBrobnyw ReiOZ1				1 B
2. <u>https://www</u> 3. https://www	w.youtube.com/watch?v=415	Mn7WIII Inc				
5. <u>https://www</u>	w.youtube.com/watch/v=1jr	wipz w UUcc				
tough	alik we How	var fr	þ	de B	hour. A	
V.	c-S-felte	lalia	-	Ales	~	



- https://www.youtube.com/watch?v=OgNVUZvB9Ow 4.
- 5. https://www.youtube.com/watch?v=OfTIrsSliLM
- 6. https://www.youtube.com/watch?v=LquflXdZRVo

13. Books Recommended

- 1. Fluency in English-II, Department of English, Delhi University, Oxford University Press.
- 2. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
- 3. English Vocabulary in Use (Advanced), Michael McCarthy and Felicity, CUP.
- 4. Learning-Spoken English by Lynn Lundquist-ASIN: B0094XNOPW.
- 5. Essential English Grammar: A Self-Study Reference and Practice Book for Elementary

prodition Mary Port



1.	Name of the De	epartment: Phys	sics	5					
2.	Course Name	Mechanics		L			Т		Р
3.	Course Code	17030101		3			0	1	0
4.	Type of Course	e (use tick	Co	ore $()$	DSE ()		AEC ()	SEC ()	GE ()
	mark)								Ů
5.	Pre-requisite		6.	Frequency	Even ()		Odd $()$	Either	Every
	(if any)			(use tick				Sem ()	Sem()
				marks)					
7.	Total Number	of Lectures, Tu	tor	ials, Practica	1				
Le	ctures = 40		_	Tutorials =	0	P	ractical = 0		
8.	Course Descrip	otion:							

The course will teach about the fundamental concept of mechanics and their subsequent development in applications in various field like oscillations and waves, elastic properties of materials, rest, motion and relative motion etc.

9. Course Objectives:

The aim of this course is to understand the basic concepts for the development of mechanics such as mathematical concept in physics, oscillations and waves, elastics properties of materials, momentum and energy etc.

10. Course Outcomes (COs):

After going through this course, the student

1. Will have understanding of Mechanics knowledge

2. Can implement, the elastic properties of the materials in everyday life

3. Acquire skills to understand the mechanism of satellite motion,

4. Help students in critical thinking and problem solving.

11. Unit wise detailed content

Unit-1 Number of lectures = 10 Title of the unit: Vectors

Vectors: Vector algebra, Scalar and vector products, Derivatives of a vector with respect to a parameter,

Oscillations: Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total Energy and their time averages, Free, forced and damped oscillations.

Unit - 2 Number of lectures = 11 Title of the unit: Momentum and Energy

Momentum and Energy: Dynamics of a system of particles, centre of mass, Conservation of momentum, Work and energy, Conservation of energy, Motion of rockets.

Rotational Motion: Angular velocity and angular momentum, Torque, Conservation of angular momentum,

Gravitation: Newton's Law of Gravitation, Kepler's Laws (statement only), Satellite in circular orbit and applications, Geosynchronous orbits, Weightlessness.

Unit -- 3 Number of lectures = 10 Title of the unit: Elasticity

Elasticity: Hooke's law - Stress-strain diagram - Elastic Moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work

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done in stretching a wire, Twisting couple on a cylinder

Unit - 4 Number of lectures = 09 Title of the unit: Special Theory of Relativity

Special Theory of Relativity: Frame of Reference, Constancy of speed of light, Postulates of Special Theory of Relativity, Length contraction, Time dilation, Twin Paradox, Relativistic addition of velocities.

12. Books Recommended

1. University Physics, FW Sears, MW Zemansky and HD Young13/e, 1986, Addison-Wesley (ISBN-10- 0201603225; ISBN-13 : 978-0201603224)

2. Mechanics Berkeley Physics course, v,1: Charles Kittel, et, Al, 2007, Tata McGraw-Hill, (ISBN:9780070667280, 0070667284)

3. Physics – Resnick, Halliday& Walker 9/e, 2010, Wiley (ISBN: 978-1-119-30685-6)

4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole, (ISBN-10:0534369642; ISBN-13: 978-0534369644)

13. Links

1. https://nptel.ac.in/courses/122103011/6

2.http://web.mit.edu/8.01t/www/materials/modules/chapter23.pdf

3. http://www.feynmanlectures.caltech.edu/III_17.html

4. https://nptel.ac.in/courses/105108070/1

5. https://nptel.ac.in/courses/122104014/

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1. Name of the D	epartment: Phys	ics				
2. Course	Mechanics Lab	L		Т]	Р
Name	17020102	0		0		A
4. Type of Course	se (use tick	Core $()$	DSE ()	AECO	SEC O	GEO
mark)						
5. Pre-requisite		6. Frequency	Even ()	Odd	Either	Every
(if any)		(use tick marks)		(٧)	Sem ()	Sem ()
7. Total Number	of Lectures, Tut	orials, Practical		1		
Lectures = 0		Tutorials = 0	Prac	tical $= 36$		
8. Course Descri	ption:			-	1	
The experiment	has been design	ed in such a wa	ay the st	udent can	measure	distance
uptomicrometer se	cale, can determi	ne elastic constar	nt of diffe	erent mate	rials and	calculate
moment of inertia	of regular and irre	gular bodies.				
9. Course Objec	tives:					
The aim of this pap	per is that the stud	ent performs the ex	periment b	based on the	e descripti	on and
how to calculate di	fferent type of err	ors also he/she und	ard value v	wherever ap	oplicable a	nd know
verified experimen	tally.	ors also ne/she und	cistand no	w the theory	ctical con	cepts are
10. Course Outco	mes (COs):					
A Q			1 11 4	:0		
After successful co	ompletion of the co	burse, students will	be able to	verify		
1. The theoretica	il formulas by perf	forming experiment	t			
2. Demonstrate t	he practical applic	ation of properties	of materia	ls etc. in ad	ctual pract	ice
11. List of Experi	ments					
1. Moment of In-	ertia of a fly-whee	1.				
2. M.I. of an irre	gular body using a	torsion pendulum.				
3. Surface Tensie	on by Jeager's me	thod.				
4. Young module	us by bending of b	eam.				
5. Modulus of rig	gidity by Maxwell	's needle.				
6. Elastic constan	nts by Searle's me	thod.				
7. Viscosity of w	ater by its flow th	rough a uniform ca	pillary tub	e.		
8. Thermal cond	uctivity of a good	conductor by Searl	e's method	1.		
9. Mechanical ec	uivalent of Heat b	y Callender's and	Barne's me	ethod.		
10. 'g' by Bar per	idulum.					
12. Book Recomm	ended					
1.Advanced Practic	cal Physics for stu	dents, B.L.Flint and	H.T.Wor	snop, 1971	, Asia Pub	lishing
House ISBN-10:0	423738909, ISBN Practical Physics	-13:978-0423738 Indu Parkash, Pam	902 Krishan a	nd A K Iba	11 th	
Edition.2011. Kital	b Mahal. New Del	hi. ISBN-10 : 8122	504167. IS	SBN-13:9	, 11 78-81225()4163
3.B.Sc. Practical P	hysics, C.L. Arora	S.Chand & Compa	any, 2010	ISBN-10 :	81219090	90
L		• 1 lad	h 010	8	1	
Ale	orx /	Multon-	nee	F	and	

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4.Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd, ISBN: 9788131525203

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			Concerne and			2
1. Name of the De	epartment: Chemistr	у		· · · · · · · · · · · · · · · · · · ·		
2. Course Name	Atomic Structure, C	Chemical Bonding,	L	Т		Р
	Chemical Energetics	and Equilibria				
3. Course Code	17030103		3	0		0
4. Type of Course	e (use tick mark)	Core (✓)	DSE ()	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even ()	Odd (✔)	Either	Every
(if any)		(use tick marks)			Sem ()	Sem ()
7. Total Number	of Lectures, Tutorial	ls, Practicals				
Lectures = 40		Tutorials =	= 0	Practical =	= 0	
8. Course Descrip	otion					
This course will	help the students to u	understand and ration	alize the c	oncepts of	atomic stru	cture and
chemical bonding.						
This course aims t	o explain the physical	world around us by de	escribing im	portant prin	ciples and o	lefinitions
of thermochemist	ry. Through Laws c	of thermodynamics, of	energetics	of reactions	will be	explained
Calculation of bor	nd energy, bond dissoc	ciation energy, resona	nce energy.	entropies a	nd enthalpi	es will be
demonstrated. In	addition, concepts rela	ated to chemical equi	librium (Gi	bb's Free E	Energy, Le	Chatlier's
Principle) will be	discussed.				0.	
Equilibria in term	of ions will also be e	explained. Important of	concepts inc	lude strong	, moderate	and weak
electrolytes; ioniza	ation of water; ionizat	ion of weak acids and	bases; com	mon ion ef	fect: pH sca	ale: buffer
solutions; and solu	bility of sparingly sol	uble salts			71	
9. Course Object	ives					
The objectives of	this course are to:		8 3			
1. Introduce the in	sights of atomic struct	tures with reference to	quantum m	nechanics.		
2. To learn the cor	ncepts of chemical bon	ding with the help the	e different th	neories.		
3. Introduce studer	nts to energetics of che	emical reactions throu	gh Laws of	Thermodyr	amics	
4. learn various co	ncepts of chemical an	d ionic equilibria				
10. Course Outco	mes (COs)			ana na sa		

Upon successful completion of this course, the student will be able to:

1. Predict complete structure of atom with electronic configurations

2. Explain ionic and covalent bonding in detail.

3. Explain energetics of chemical reactions through important principles and definitions of thermo chemistry

4. Explain degree of ionization and the differences between strong, moderate and weak electrolytes and other important concepts of chemical equilibria

11. Unit wise detailed content

Unit-1 Number of lectures = 10 Title of the unit: Atomic Structure

Atomic Structure: Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure.

Introduction to Quantum mechanics. Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2 , Schrödinger equation for hydrogen atom. Radial and angular parts of the hydrogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Significance of quantum numbers and orbital angular momentum. Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s). Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

Unit-2	Number of lectures = 10	Title of the unit: Chemical Bonding and Molecular
		Structure

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

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Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

Concept of resonance and resonating structures in various inorganic and organic compounds.

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for ss, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO+. Comparison of VB and MO approaches.

Unit-3 Number of lectures = 10 Title of the unit: Chemical Energetics

Review of thermodynamics and the Laws of thermodynamics

Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature- Kirchoff's equation.

Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

Unit-4	Number of lectures = 10	Title of the unit: Chemical Equilibrium and Ionic Equilibria

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG^0 , Le Chatlier's Principle.

Relationships between K_p, K_c and K_x for reactions involving ideal gases.

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis- calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts- applications of solubility product principle.

12. Brief Description of self-learning/ E - learning component

- 1. http://www.digimat.in/nptel/courses/video/104106096/L19.html
- 2. https://ncert.nic.in/ncerts/l/lech104.pdf
- 3. https://nptel.ac.in/courses/104/106/104106089/

13. Books Recommended

- 1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991 ISBN 0-412-40290-4
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley, ISBN 0471505323.
- 3. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006, ISBN 978-0060429959
- 4. The Principles of Chemical Equilibrium: With Applications in Chemistry and Chemical Engineering 4th Edition, by KG Denbigh, Cambridge University Press, ISBN 978-0521281508



1. Name of the Depa	rtment: Chemistry					
2. Course Name	Atomic Structure, C	hemical Bonding,	L		Τ	P
	Chemical Energetics a	and Equilibria Lab				
3. Course Code	17030104		0		0	4
4. Type of Course (u	se tick mark)	Core (✓)	DSE ()	AEC () SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even ()	Odd (() Either	Every
(if any)		(use tick marks)			Sem ()	Sem ()
7. Total Number of I	Lectures, Tutorials, Pra	acticals				
Lectures = 0		Tutorials = 0		Practi	cal = 52 hrs.	
8. Course Descriptio	n					
The lab work emphas	izes learning of basic sk	ills helpful not only	to chemis	try stude	ents but all the	ose who
want to pursue any ex	perimental science. It in	cludes using instrur	nents, to d	letermin	e physical par	ameters,
2.g., neat capacity, en	inalpy, solubility and pr	1. It also includes vo	olumetric a	analysis	of compound	S.
The objectives of this	course are to:					
1 Introduce stu	course are to:	amical reactions the	ough louve	ofthom	nodunamias	
2 Explain vario	us concents of chemical	and ionic equilibria	oughlaws	or merr	nouynamics	
3 Determination	a of strength of solution	through volumetric	analysis			
4. Learn separat	ion of Na ₂ CO ₃ and NaH	CO_3 by volumetric	analysis			
10. Course Outcome	s (COs)	eejej volumente	unungono			
Upon successful com	pletion of this course, th	e student will be ab	le to:			
1. Learn various	s experimental concepts	s of thermochemist	ry such a	s heat c	apacity, enth	alpy and
solubility usir	ng different solutions				······································	
2. Preparation of	f buffer solutions and de	termination of pH of	of various	solution	s, for instance	, aerated
drinks, fruit ju	lices, shampoos and soa	ps				
3. Predict the tec	chnique of volumetric ar	nalysis				
4. Determine str	engths of Fe(II), Cu(II)	solutions	S. Stand			
1. List of Experime	nts (Student has to per	form ten experime	nts – at le	east two	from each se	ection)
Section A: Physical (Chemistry					
I nermochemistry	afhaat annaite af anta	····· · · · · · · · · · · · · · · · ·	1			
1. Determination	of anthalmy of noutralis	orimeter for differen	it volumes	41		
2. Determination	of enthalpy of neutralized	zation of hydrochiol	ric acid wi	th sodiu	m hydroxide.	
4 Determination	of integral enthalpy of	solution of salts (K)	NO2 NH	CD		
5. Determination	of enthalpy of hydratio	on of conner sulphat	P	CI).		
6. Study of the s	olubility of benzoic acid	in water and deter	o. nination o	f H		
lonic equilibria	oracinity of conzore acre	in water and deten	milation o	1 11.		
1. pH measurem	ents					
2. Measurement	of pH of different soluti	ons like aerated drir	nks. fruit iu	lices, sh	ampoos and s	oaps (use
dilute solution	is of soaps and shampoo	s to prevent damage	e to the gla	ass elect	rode) using pl	H-meter.
3. Preparation of	f buffer solutions: Sodiu	m acetate-acetic aci	d			
Ammonium c	hloride-ammonium hydr	roxide				
4. Measurement	of the pH of buffer solu	tions and compariso	on of the v	alues wi	th theoretical	values.
Section B: Inorganic	Chemistry - Volumetr	ic Analysis				
1. Estimation of	sodium carbonate and s	odium hydrogen cai	rbonate pro	esent in	a mixture.	
2. Estimation of	oxalic acid by titrating i	t with KMnO ₄ .				
3. Estimation of	water of crystallization	in Mohr's salt by tit	trating wit	h KMnC) ₄ .	
4. Estimation of 5. Estimation of	Fe (II) ions by titrating i	It with $K_2Cr_2O_7$ using the second secon	ng internal	indicate	or.	
5. Estimation of 2 Priof Deceription	Cu (II) ions iodometrica	ally using $Na_2S_2O_3$.			<u> </u>	
1 https://wlah.cm	rita edu/20ub-2 check-1	101 Proim-244 Prost	-1			
2 http://bhag.ac.	n/wp-content/uploads/2	015/08/Prostical fin	-1	n ndf		
3. https://pubs.ac.	s org/doi/abs/10 1021/ad	1007p724	st-semeste	a.pul		
13. Books Recommen	nded	100/p/24				
<u> </u>	. /	the d	N.			



- 1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012, ISBN, 978-8131773710.
- 2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009, ISBN 9788131723258.
- 3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011), ISBN 978-81-265-3016-8.
- 4. B Viswanathan, PS Raghavan, Practical Physical Chemistry, Viva Books, ISBN 978-8130929699.

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1.	Name of the Depa	artment: Math	ematics				
2.	Course Name	Calculus	L		Т	Р	
3.	Course Code	17030105	3		0		0
4.	Type of Course (mark)	use tick	Core (🖋	DSE ()	AEC ()	SEC 0	OE ()
5.	Pre-requisite		6. Frequency	Even ()	Odd (Either	Every
	(if any)		(use tick	-		Sem	Sem ()
1.4			marks)			0	
7.	Total Number of	Lectures, Tut	orials, Practical				
Le	ctures = 40		Tutorials =	= 0	Practical =	= 0	
8.	Course Descripti	on:					
Th lim app wit for fun	is course is design its, continuity, de propriate models ar hout technology, e mulas and various actions.	ed to develop rivatives. Upon ad techniques for evaluation of ar techniques of in	the topics of dif n completion, str or finding solution reas, volumes of ntegration applied	ferential ca udents shou ns to deriva revolution, d to both sir	lculus. Emp ild be able tive-related force, and v ngle variable	hasis is p to select problems work; fun and mul	placed on and use with and damental tivariable

9. Course Objectives:

Students that successfully complete this course will be able to:

1. Learn to find and use limits of functions,

2. To understand Rolle's Theorem, Mean Value theorems, series and Maclaurin's series.

- 3. Understand the meaning of differentiation and integration.
- 4. Apply the various methods of calculating derivatives of a function.

10. Course Outcomes (COs):

After completing the course, students are expected to be able:

- 1. To understand limits, continuity and differentiability of functions in two variables and their properties.
- 2. To expand the two variables functions in series, form and discuss the maxima & minima using expansion of functions.
- 3. To understand the concept of asymptotes and curve tracing of the functions and their properties.
- 4. To evaluate the double & triple integral and apply the multiple integrals to find the area and volume.

11. Unit wise detailed content

Unit – 1	Number of lectures = 12	Title of the unit: Continuity and Differentiation	
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Limit and Continuity, Types of discontinuities, Differentiability of functions, Successive differentiation, n^{th} Differentiation of functions, Leibnitz's theorem, Limit, Continuity & Differentiability of functions in two variables, Partial differentiation, Euler's theorem on homogeneous functions and Jacobians.

Unit – 2	Number of lectures = 08	Title of the unit: Mean Value Theorems and
		Series expansions

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms

of remainder, Taylor's series, Maclaurin's series of $\sin x$, $\cos x$, e^x , $\log(1+x)$, $(1+x)^m$, Taylor's theorem in two variables, Maxima and Minima of two variable functions,

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Unit – 3	Number of lectures = 10	Title of the unit: Asymptote and Curve Tracing
		and Curvature
Asymptot	es in cartesian coordinates, A	symptotes in polar coordinates, Oblique asymptotes,
Concavity	, Convexity & Points of Inflex	kion, Tangents and normal curvature, Singular points,
Tracing o	f curves in cartesian, Parametric	and Polar coordinates, Curvature, Radius of curvature
for cartesi	an curves, Parametric curves, P	olar curves.
Unit – 4	Number of lectures = 10	Title of the unit: Multiple Integrals and its
		Applications
Double in	tegral in cartesian and polar for	rm, Change of order of integration, Double integral by
changing	the variable, Area, Triple inte	egral in cartesian, Triple integration by changing the
variable in	n cylindrical and spherical coord	dinates, Volume.
12. Brief	Description of self-learning / 1	E-learning component
1. https	://nptel.ac.in/courses/111/104/1	11104085/
2. <u>https</u>	://nptel.ac.in/courses/111/107/1	11107108/
13. Books	Recommended	

- 1. Thomas and Finny, Calculus (9th ed.), Addison-Wesley, 1996.
- 2. Anton, Howard, Bivens, Irl, & Davis, Stephen, Calculus (10th ed.). John Wiley & Sons Singapore Pte. Ltd. Indian Reprint (2016).
- 3. D.V. Widder, Advanced Calculus (2nd ed.), Prentice Hall of India Pvt. Ltd, New Delhi, 2012.
- 4. Gorakh Prasad: Differential Calculus, Pothishasla Pvt. Ltd. Allahabad 2016.
- 5. Shanti Narayan And P. K. Mittal, Integral Calculus (35th ed.), S. Chand, New Delhi, 2005.

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2. Course Name Calculus Lab L T P 3. Course Code 17030106 0 0 4 4. Type of Course (use tick marks) Core (I) DSE (I) AEC (I) OE (I) 5. Pre-requisite (if any) 6. Frequency (use tick marks) DSE (I) Odd (I) Every Sem Every Sem Sem 0 0 7. Total Number of Lectures, Tutorials, Practical Lectures = 0 Tutorials = 0 Practical = 52 Sem Sem 0 Sem 0 Sem Sem 0 Sem Sem 0 Sem 0 Sem	2 Course Name Calculus Lab L T P 3. Course Code 17030106 0 0 4 4. Type of Course (use tick mark) Core (I DSE 0 AEC 0 SEC OB 0 5. Pre-requisite (if any) 6. Frequency (use tick marks) Even 0 Od (I Ether Sem Se	1. Name of the De	partment: Matl	hematics				
3. Course Code 17030106 0 0 4 4. Type of Course (use tick mark) Core (I) DSE (I) AEC (I) OE (I) 5. Pre-requisite (if any) 6. Frequency (use tick marks) Even (I) Odd (I) Either Sem (I) Sem (I) 7. Total Number of Lectures, Tutorials, Practical Even (I) Odd (I) Either Sem (I) Sem (I) 8. Course Description: Tutorials = 0 Practical = 52 Sem (I) Sem (I) Sem (I) 7. Total Number of Lectures, and work; fundamental formulas and various technique of integration applied to both single variable and multivariable functions. Even (I) Odd (I) Even (I) Sem (I)	3. Course Code 17030106 0 0 AEC 0 SEC DE 0 4. Type of Course (use tick marks) Core (v) DSE 0 AEC 0 SEC DE 0 5. Pre-requisite (fram) 6. Frequency (use tick marks) Even 0 Odd (v) Either Even 5 Sem 5 7. Total Number of Lectures, Tutorials, Practical Intorials = 0 Practical = 52 Sem 5 Sem 5 8. Course Description: This course is designed to emphasize the knowledge of differential calculus using the visi picture of the function. Emphasis is placed on limits, continuity, derivatives, evaluat of areas, volumes of revolution, force, and work; fundamental formulas and various techniq of integration applied to both single variable and multivariable functions: 9. 9. Course Objectives: Students that successfully complete this course will be able to: 1. 10 9. Discuss the existence of limits and continuity of a function with graphs. 2. 10 10 2. Discuss the existence of structures of a function with graphs. 3. 1. 10 10 10 1. To be able to evaluate various limit & continuity problem 2. 2. 10 10 10 2. Calcula is a primary gateway to an engineering and technology 3. 1. 10	2. Course Name	Calculus Lab	L	T			P
4. Type of Course (use tick mark) Core () DSE () AEC () SEC () QE () 5. Pre-requisite (if any) 6. Frequency (use tick marks) Even () Odd () Either Sem () Sem () 7. Total Number of Lectures, Tutorials, Practical Lectures = 0 Tutorials = 0 Practical = 52 Sem () Sem	4. Type of Course (use tick mark) Core (I) DSE 0 AEC 0 SEC 0 0 9. Pre-requisife (if any) 6. Frequency (use tick marks) 0 Odd (I) Sem	3. Course Code	17030106	0		0		4
mark) O 5. Pre-requisite (if any) 6. Frequency (use tick marks) Even () Odd () Either Sem Every Sem 7. Total Number of Lectures, Tutorials, Practical Lectures = 0 Practical = 52 8. Course Description: Tutorials = 0 Practical = 52 8. Course Description: Tutorials, continuity, derivatives, evaluation of areas, volumes of revolution, force, and work; fundamental formulas and various technique of integration applied to both single variable and multivariable functions. 9. Course Objectives: Students that successfully complete this course will be able to: 1. Discuss the existence of limits and continuity of a function with graphs. 2. Discuss the existence of derivatives of a function with graphs. 3. Understand the meaning of differentiation and integration. 4. Apply the various methods of calculating derivative of a function 10. Course Outcomes (COS): After completing the course, students are expected 1. To be able to evaluate various limit & continuity problem 2. Calculus is a primary gateway to an engineering and technology 3. Properly carry out integration through the use of the fundamental formulae and/or the various techniques of integration.	mark 0 0 5. Pre-requisite (if any) 6. Frequency (use tick marks) Even 0 Odd (I) Ether Even 0 7. Total Number of Lectures, Tutorials, Practical Interval Inte	4. Type of Course	(use tick	Core (🖌	DSE ()	AEC ()	SEC	OE ()
5. Pre-requisite (if any) 6. Frequency (use tick marks) Even () Odd () Either Sem () Every Sem () 7. Total Number of Lectures, Tutorials, Practical Lectures = 0 Tutorials = 0 Practical = 52 8. Course Description: This course is designed to emphasize the knowledge of differential calculus using the visib picture of the function. Emphasis is placed on limits, continuity, derivatives, evaluation of areas, volumes of revolution, force, and work; fundamental formulas and various technique of integration applied to both single variable and multivariable functions. 9. Course Objectives: Students that successfully complete this course will be able to: 1. Discuss the existence of limits and continuity of a function with graphs. 2. Discuss the existence of derivatives of a function with graphs. 3. Understand the meaning of differentiation and integration. 4. Apply the various methods of calculating derivative of a function 10. Course Outcomes (COs): After completing the course, students are expected 1. To be able to evaluate various limit & continuity problem 2. Calculus is a primary gateway to an engineering and technology 3. Properly carry out integration through the use of the fundamental formulae and/or the various techniques of integration. 11. The list of practicals to perform in the computer lab.	5. Frequency (if any) 6. Frequency (use fick marks) Even 0 Odd () Either Sem Sem Sem 7. Total Number of Lectures, Tutorials, Practical Lectures = 0 Tutorials = 0 Practical = 52 8. Course Description: This course is designed to emphasize the knowledge of differential calculus using the visi picture of the function. Emphasis is placed on limits, continuity, derivatives, evaluat of areas, volumes of revolution, force, and work; fundamental formulas and various techniq of integration applied to both single variable and multivariable functions. 9. Course Objectives: 9. Students that successfully complete this course will be able to: 1. 1. Discuss the existence of dirivatives of a function with graphs. 3. 2. Discuss the existence of dirivatives of a function 4. 4. Apply the various methods of calculating derivative of a function. 4. 4. Apply the various methods of calculating derivative of a function. 4. 2. Clause Outcomes (COS): 4. After completing the course, students are expected 1. 1. To be able to evaluate various limit & continuity problem 2. 2. Calculus is a primary gateway to an engineering and technology 3. 3. Properly carry out integration 11. 11. The list of practicals to perform in the computer lab. <td< td=""><td>mark)</td><th></th><td></td><td></td><td></td><td>0</td><td></td></td<>	mark)					0	
(If ality) (use tick marks) Sem Sem Q 7. Total Number of Lectures, Tutorials, Practical Q Lectures = 0 Tutorials = 0 Practical = 52 8. Course Description: This course is designed to emphasize the knowledge of differential calculus using the visib picture of the function. Emphasis is placed on limits, continuity, derivatives, evaluatic of areas, volumes of revolution, force, and work; fundamental formulas and various technique of integration applied to both single variable and multivariable functions. 9. Course Objectives: Students that successfully complete this course will be able to: 1. Discuss the existence of limits and continuity of a function with graphs. 2. Discuss the existence of derivatives of a function with graphs. 3. Understand the meaning of differentiation and integration. 4. Apply the various methods of calculating derivative of a function 10. Course Outcomes (COs): After completing the course, students are expected 1. To be able to evaluate various limit & continuity problem 2. Calculus is a primary gateway to an engineering and technology 3. Properly carry out integration through the use of the fundamental formulae and/or the various techniques of integration.	Utually Sem Sem Original Sector 7. Total Number of Lectures, Tutorials, Practical 0 Lectures = 0 Tutorials = 0 Practical = 52 8. Course Description: 1 This course is designed to emphasize the knowledge of differential calculus using the visi picture of the function. Emphasis is placed on limits, continuity, derivatives, evaluat of areas, volumes of revolution, force, and work; fundamental formulas and various techniq of integration applied to both single variable and multivariable functions. 9. Course Objectives: Students that successfully complete this course will be able to: 1. Discuss the existence of derivatives of a function with graphs. 2. Discuss the existence of derivatives of a function with graphs. 2. Discuss the existence of derivatives of a function with graphs. 3. Understand the meaning of differentiation and integration. 4. Apply the various methods of calculating derivative of a function 4. Apply the various methods of calculating derivative of a function 10. Course Outcomes (COS): Calculus is a primary gateway to an engineering and technology 3. Properly carry out integration through the use of the fundamental formulae and/or the various techniques of integration. 11. The list of practicals to perform in the computer lab. 1. To calculate limit, right hand limit and left hand limit of functions and draw the graph the function 2. To calculate continuity of functions and draw the graph 4. To calculate derivatives of a one and tw	5. Pre-requisite		6. Frequency	Even ()	Odd (🖍	Either	Every
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Lectures = 0 Tutorials = 0 Practical = 52 8. Course Description: This course is designed to emphasize the knowledge of differential calculus using the visib picture of the function. Emphasis is placed on limits, continuity, derivatives, evaluation of areas, volumes of revolution, force, and work; fundamental formulas and various technique of integration applied to both single variable and multivariable functions. 9. Course Objectives: Students that successfully complete this course will be able to: 1. Discuss the existence of limits and continuity of a function with graphs. 2. Discuss the existence of derivatives of a function with graphs. 3. Understand the meaning of differentiation and integration. 4. Apply the various methods of calculating derivative of a function 10. Course Outcomes (COs): After completing the course, students are expected 1. To be able to evaluate various limit & continuity problem 2. Calculus is a primary gateway to an engineering and technology 3. Properly carry out integration through the use of the fundamental formulae and/or the various techniques of integration. 11. The list of practicals to perform in the computer lab.	Lectures = 0 Tutorials = 0 Practical = 52 8. Course Description: This course is designed to emphasize the knowledge of differential calculus using the visi picture of the function. Emphasis is placed on limits, continuity, derivatives, evaluat of areas, volumes of revolution, force, and work; fundamental formulas and various techniqo of integration applied to both single variable and multivariable functions. 9. Course Objectives: Students that successfully complete this course will be able to: 1. Discuss the existence of limits and continuity of a function with graphs. 3. Understand the meaning of differentiation and integration. 4. Apply the various methods of calculating derivative of a function Integration applied to both single variable and multivariable function. 10. Course Outcomes (COS): After completing the course, students are expected 1. To be able to evaluate various limit & continuity problem 2. Calculus is a primary gateway to an engineering and technology 3. Properly carry out integration through the use of the fundamental formulae and/or the various techniques of integration. 11. The list of practicals to perform in the computer lab. 1. To calculate limit, right hand limit and left hand limit of functions and draw the graph the function 2. To calculate continuity of functions and draw the graph of the function 3. To dientify points of discontinuity with the help of graph 4. To calculate activatives of a one and two variable functions. 10. Coursecourse of a one and two variable functions. </td <td>7. Total Number of</td> <th>of Lectures. Tut</th> <td>orials. Practical</td> <td></td> <td></td> <td></td> <td></td>	7. Total Number of	of Lectures. Tut	orials. Practical				
 8. Course Description: This course is designed to emphasize the knowledge of differential calculus using the visib picture of the function. Emphasis is placed on limits, continuity, derivatives, evaluation of areas, volumes of revolution, force, and work; fundamental formulas and various technique of integration applied to both single variable and multivariable functions. 9. Course Objectives: Students that successfully complete this course will be able to: Discuss the existence of limits and continuity of a function with graphs. Discuss the existence of derivatives of a function with graphs. Understand the meaning of differentiation and integration. 4. Apply the various methods of calculating derivative of a function 10. Course Outcomes (COS): After completing the course, students are expected To be able to evaluate various limit & continuity problem Calculus is a primary gateway to an engineering and technology Properly carry out integration through the use of the fundamental formulae and/or the various techniques of integration. 11. The list of practicals to perform in the computer lab. 	 8. Course Description: This course is designed to emphasize the knowledge of differential calculus using the visi picture of the function. Emphasis is placed on limits, continuity, derivatives, evaluat of areas, volumes of revolution, force, and work; fundamental formulas and various techniq of integration applied to both single variable and multivariable functions. 9. Course Objectives: Students that successfully complete this course will be able to; 1. Discuss the existence of limits and continuity of a function with graphs. 2. Discuss the existence of derivatives of a function with graphs. 3. Understand the meaning of differentiation and integration. 4. Apply the various methods of calculating derivative of a function 10. To be able to evaluate various limit & continuity problem 2. Calculus is a primary gateway to an engineering and technology 3. Properly carry out integration through the use of the fundamental formulae and/or the various techniques of integration. 11. The list of practicals to perform in the computer lab. 1. To calculate continuity of functions and draw the graph of the function 3. To identify points of discontinuity with the help of graph 4. To calculate derivatives of a one and two variable functions with graph 5. To discuss the applicability of Mean value theorems 8. To find Jacobians of the functions in two and three variables. 6. To discuss the applicability of Nean value theorems 8. To find Taylor's and Maclaurin's series 9. To find the maximum and minimum of two variable functions. 10. Evaluate integrals using a change of variable. 11. Evaluate integrals using a change of variable. 12. Evaluate integrals using a change of variable. 13. To ident poly of self-learning / E-learning component 	Lectures = 0		Tutorials =	• 0	Practical =	52	and the
 This course is designed to emphasize the knowledge of differential calculus using the visib picture of the function. Emphasis is placed on limits, continuity, derivatives, evaluation of areas, volumes of revolution, force, and work; fundamental formulas and various technique of integration applied to both single variable and multivariable functions. 9. Course Objectives: Students that successfully complete this course will be able to: Discuss the existence of limits and continuity of a function with graphs. Discuss the existence of derivatives of a function with graphs. Understand the meaning of differentiation and integration. Apply the various methods of calculating derivative of a function 10. Course Outcomes (COs): After completing the course, students are expected To be able to evaluate various limit & continuity problem Calculus is a primary gateway to an engineering and technology Properly carry out integration through the use of the fundamental formulae and/or the various techniques of integration. 11. The list of practicals to perform in the computer lab. 	This course is designed to emphasize the knowledge of differential calculus using the visi picture of the function. Emphasis is placed on limits, continuity, derivatives, evaluat of areas, volumes of revolution, force, and work; fundamental formulas and various techniq of integration applied to both single variable and multivariable functions. 9. Course Objectives: Students that successfully complete this course will be able to: 1. Discuss the existence of derivatives of a function with graphs. 2. Discuss the existence of derivatives of a function with graphs. 3. Understand the meaning of differentiation and integration. 4. Apply the various methods of calculating derivative of a function 10. Course Outcomes (COS): After completing the course, students are expected 1. To be able to evaluate various limit & continuity problem 2. Calculus is a primary gateway to an engineering and technology 3. Properly carry out integration through the use of the fundamental formulae and/or the various techniques of integration. 11. The list of practicals to perform in the computer lab. 1. To calculate limit, right hand limit and left hand limit of functions and draw the graph the function 2. To calculate continuity of functions and draw the graph of the function 3. To identify points of discontinuity with the help of graph 4. To calculate derivatives of a one and two variable functions with graph 5. To find Jacobians of the functions in two and three variables. 6. To discuss the applicability of Mean value theorems through graph 7. To calculate value of 'c' using Mean value theorems 8. To find Taylor's and Maclaurin's series 9. To find the maximum and minimum of two variable functions, 10. Evaluate double and triple integrals. 11. Evaluate integrals using a change of variable. 12. Evaluate Area and volume 12. Brief Description of self-learning / E-learning component	8. Course Descript	tion:					2.1
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	 6. To discuss the applicability of Mean value theorems through graph 7. To calculate value of 'c' using Mean value theorems 8. To find Taylor's and Maclaurin's series 9. To find the maximum and minimum of two variable functions. 10. Evaluate double and triple integrals. 11. Evaluate integrals using a change of variable. 12. Evaluate Area and volume 12. Brief Description of self-learning / E-learning component <i>Model Wallow </i>	5. To find Jacol	bians of the func	tions in two and th	ree variable	s with graph		
5. To find Jacobians of the functions in two and three variables	 7. To calculate value of 'c' using Mean value theorems 8. To find Taylor's and Maclaurin's series 9. To find the maximum and minimum of two variable functions. 10. Evaluate double and triple integrals. 11. Evaluate integrals using a change of variable. 12. Evaluate Area and volume 12. Brief Description of self-learning / E-learning component WWW WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW	6. To discuss th	e applicability o	f Mean value theo	rems throug	gh graph		
 To find Jacobians of the functions in two and three variables. To discuss the applicability of Mean value theorems through graph 	 8. To find Taylor's and Maclaurin's series 9. To find the maximum and minimum of two variable functions. 10. Evaluate double and triple integrals. 11. Evaluate integrals using a change of variable. 12. Evaluate Area and volume 12. Brief Description of self-learning / E-learning component WM WM	7. To calculate	value of 'c' usin	g Mean value theo	orems			
 To find Jacobians of the functions in two and three variables. To discuss the applicability of Mean value theorems through graph To calculate value of 'c' using Mean value theorems 	 9. To find the maximum and minimum of two variable functions. 10. Evaluate double and triple integrals. 11. Evaluate integrals using a change of variable. 12. Evaluate Area and volume 12. Brief Description of self-learning / E-learning component <i>WMW WMW</i>	8. To find Taylo	or's and Maclaur	rin's series				
 To find Jacobians of the functions in two and three variables. To discuss the applicability of Mean value theorems through graph To calculate value of 'c' using Mean value theorems To find Taylor's and Maclaurin's series 	10. Evaluate double and triple integrals. 11. Evaluate integrals using a change of variable. 12. Evaluate Area and volume 12. Brief Description of self-learning / E-learning component WM MM MM	9. To find the m	naximum and mi	nimum of two var	iable function	ons.		
 To find Jacobians of the functions in two and three variables. To discuss the applicability of Mean value theorems through graph To calculate value of 'c' using Mean value theorems To find Taylor's and Maclaurin's series To find the maximum and minimum of two variable functions. 	11. Evaluate integrals using a change of variable. 12. Evaluate Area and volume 12. Brief Description of self-learning / E-learning component WM MM	10. Evaluate dou	ble and triple int	tegrals.				
 To find Jacobians of the functions in two and three variables. To discuss the applicability of Mean value theorems through graph To calculate value of 'c' using Mean value theorems To find Taylor's and Maclaurin's series To find the maximum and minimum of two variable functions. Evaluate double and triple integrals. 	12. Evaluate Area and volume 12. Brief Description of self-learning / E-learning component Ministry Ministry Image: Area and volume Ima	11. Evaluate inte	grals using a cha	ange of variable.				
 5. To find Jacobians of the functions in two and three variables. 6. To discuss the applicability of Mean value theorems through graph 7. To calculate value of 'c' using Mean value theorems 8. To find Taylor's and Maclaurin's series 9. To find the maximum and minimum of two variable functions. 10. Evaluate double and triple integrals. 11. Evaluate integrals using a change of variable. 	12. Brief Description of self-learning / E-learning component	12. Evaluate Are	a and volume					
 To find Jacobians of the functions in two and three variables. To discuss the applicability of Mean value theorems through graph To calculate value of 'c' using Mean value theorems To find Taylor's and Maclaurin's series To find the maximum and minimum of two variable functions. Evaluate double and triple integrals. Evaluate integrals using a change of variable. Evaluate Area and volume 	Mi produte We coshere	12. Brief Descriptio	n of self-learnin	ng / E-learning co	mponent		-	
 5. To find Jacobians of the functions in two and three variables. 6. To discuss the applicability of Mean value theorems through graph 7. To calculate value of 'c' using Mean value theorems 8. To find Taylor's and Maclaurin's series 9. To find the maximum and minimum of two variable functions. 10. Evaluate double and triple integrals. 11. Evaluate integrals using a change of variable. 12. Evaluate Area and volume 12. Brief Description of self-learning / E-learning component								


- <u>https://in.mathworks.com/academia/courseware/teaching-calculus-with-matlab.html</u>
 <u>https://in.mathworks.com/discovery/integral.html</u>
- <u>https://www.wolfram.com/language/12/core-calculus/learn-calculus-in-a-free-</u> course.html?product=mathematica
- 4. https://www.youtube.com/watch?v=EaYEQ30K1Ww

13. Books Recommended

North

- 1. Ronald L. Lipsman (Author), Jonathan M. Rosenberg, Multivariable Calculus with
- MATLAB®: With Applications to Geometry and Physics (1st edition), Springer, 2017.
- C. Lopez, MATLAB Differential and Integral Calculus (1st edition), Apress, 2014.
 Selwn Hollis, Calculus with Mathematica: An Interactive Book, Applied Symbols.com.
- 2004.
- C. A. Knoll, M. D. Shaw, J. Johnson and B. Evans, Discovering Calculus with Mathematica (2nd edition), John Wiley & Sons, 1995.

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c.S. Lalite



SEMESTER-II (CORE)



1.	1. Name of the Department: Physics								
2.	Course Name	Electricity,		L		7	Γ		P
		Magnetism and							
		EMT							
3.	Course Code	17030201		3		()		0
4.	Type of Course	(use tick mark)	Co	ore (√)	DSE	0	AEC ()	SEC ()	GE ()
5.	Pre-requisite		6.	Frequenc	Even (()	Odd ()	Either	Every
	(if any)			У				Sem ()	Sem ()
	+			(use tick					
		т		marks)					
7.	7. Total Number of Lectures, Tutorials, Practical								
Le	Lectures = 40 Tutorials = 0 Practical = 0								
8.	8. Course Description:								

The course will teach about the vector analysis of electric field and magnetic field, integral and differential form of Maxwell equations and electromagnetic wave propagation.

9. Course Objectives:

To impart knowledge about electrostatics, magnetism, and Maxwell's equations and their practical applications.

10. Course Outcomes (COs):

After successful completion of this course, students will have

- 1. Basic understanding of electricity and magnetism, and their everyday life applications
- 2. Understanding of propagation of electromagnetic radiation in different medium like vacuum, isotropic dielectric medium etc.
- 3. Skills to design the projects based on basics of electricity and magnetism,
- 4. Assistance to students in critical thinking and problem solving.

11 Unit wise detailed content

Number of lectures =

Unit - 3

III CHIE WI	The only while dotation content						
Unit-1	Number of lectures =	Title of the unit: Vector Analysis					
	10						

Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gaussdivergence theorem and Stoke's theorem of vectors (statement only)

Unit - 2	Number of lectures =	Title of the unit: Electrostatics
	11	

Electrostatic Field, electric flux, Gauss's theorem of electrostatics, Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor, Electric potential as line integral of electric field, Energy per unit volume in electrostatic field, Dielectric medium, Polarization, Displacement vector, Gauss's theorem in dielectrics,

Title of the unit: Magnetism

Muker Deve



Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current, Divergence and curl of magnetic field, Magnetic vector potential, Ampere's circuital law, Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility, Brief introduction of dia-, para-and ferro-magnetic materials,

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, Energy stored in magnetic field.

Unit - 4	Number of lectures = 8	Title	of	the	unit:	Maxwell's	equations	and
		Electr	omag	gnetic	wave p	propagation	-	

Equation of continuity of current, Displacement current, Maxwell's equations, Pointing Theorem, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

12. Book Recommended:

11

- 1. Electricity and Magnetism, Edward M, Purcell, 1986, McGraw-Hill Education, ISBN 13: 9780070049086
- 2. Electricity and Magnetism, J,H, Fewkes& J, Yarwood, Vol, I, 1991, Oxford Univ, Press
- 3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House, ISBN-13: 978-9350975534
- 4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole, ISBN-13: 978-0534369644
- 5. D,J, Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings, ISBN-13: 9780138053260

13. links

1. https://nptel.ac.in/courses/115101005/downloads/lectures-doc/Lecture-23.pdf

2. https://nptel.ac.in/courses/113106032/15%20-%20Magnetic%20Properties.pdf

3.<u>https://theopenacademy.com/sites/default/files/oadb/Sciences/Physics/Physics%20II%3B%20</u> Electricity%20and%20Magnetism%20-%20MIT%20-%20Walter%20Lewin%20-%20PXNCSA/Notes/Course%20Notes/The Displacement Course (A a lab (a straight for the str

<u>%20BYNCSA/Notes/Course%20Notes/The-Displacement-Current-And-Maxwells-</u> Equations.pdf

4. <u>https://ocw.mit.edu/courses/mechanical-engineering/2-71-optics-spring-2009/video-lectures/lecture-14-maxwells-equations-polarization-poyntings-vector/</u>

Maker Der

5. https://www.eit.lth.se/fileadmin/eit/courses/eten05/ht2016/lectures/lecture1.pdf



•							
1.	Name of the Depa	rtment: Physics					
2.	Course Name	Electricity,	L		Т		P
		Magnetism					
-		and EMT Lab					
3.	Course Code	17030202	0		0		4
4.	Type of Course (u	se fick mark)	Core (√)	DSE ()	AEC ()	SEC 0	GE ()
5.	Pre-requisite		6.Frequency	Even $()$	Odd ()	Either	Every
	(if any)		(use tick			Sem ()	Sem ()
			marks)				
7.	Total Number of	Lectures, Tutori	als, Practical			-	
Le	ctures = 0		Tutorials =	0 1	Practical =	= 36	
8.	Course Descriptio	n:					
Ex am	periments include the plifier, Melde's exp	eriment, electron	aracteristics of l ic voltmeter, con	DC power su npound pend	pply, RC c lulum etc.	coupled	
9.	Course Objective	s:					
To Mo wh	understand the wo DSFET, LED and lich are helpful in ou	rking principles Photo diodes and r daily life.	of different typ d implement the	es of transis em into prac	tors and d ctically wo	iodes lik orking ec	ke JFET, Juipment
10	Course Outcomes	(COs):					
Af	ter successful compl	etion of the cours	se, students will	be able to:			il :
1.	Apply the concept	s of basic electro	nic devices to de	sign various	electronic	circuits.	
2. Understand operation of diodes, transistors in order to design basic circuits.							
3. Measure frequency of A.C. mains by sonometer using an electromagnet.							
4. Measure low resistance by Carey Foster's Bridge							
11	11. List of Experiments						
1	1 To draw common base and common emitter characteristics of a transistor and coloulate						

- 1. To draw common base and common emitter characteristics of a transistor and calculate transistor characteristics parameters.
- 2. To study the ripple factor in a D.C. power supply.
- 3. To draw frequency response curve of transistorized R.C. coupled amplifier.
- 4. To find out the frequency of a tuning fork by Melde's experiment.
- 5. Study of series and parallel resonance circuits.
- 6. Electronic Voltmeter measurement of peak, average & R.M.S. values of signal.
- 7. Study of voltage doubler and trippler circuits.
- 8. Frequency of A.C. mains by sonometer using an electromagnet.

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- To find Jacobians of the functions in two and three variables. 5.
- To discuss the applicability of Mean value theorems through graph 6.
- To calculate value of 'c' using Mean value theorems 7.
- To find Taylor's and Maclaurin's series 8.
- 9. To find maximum and minimum of two variable functions.
- 10. Evaluate double and triple integrals.
- 11. Evaluate integrals using a change of variable.

12. Evaluate Area and volume

- 1. Gurpreet Singh Tuteja, "Practical Mathematics, International BOOK house Pvt Ltd.
- 2. https://www.mathworks.com/help/symbolic/solve-a-single-differential-equation.html
- 3. https://in.mathworks.com/help/symbolic/solve-a-system-of-differential-equations.html
- 4. https://www.mathworks.com/help/matlab/math/choose-an-ode-solver.html
- 5. http://www.math.tamu.edu/undergraduate/research/REU/comp/matode.pdf

11. Books Recommended

- Shanti Narayan: Differential and Integral Calculus. 1.
- Murray R.Speigel: Theory and Problems of Advanced Calculus, Schaum's Outline series, 2. Schaum Publishing Co., New York.
- N. Piskunov: Differential and Integral Calculus, Peace Publishers, Moscow. 3.
- Gorakh Prasad: Differential Calculus, Pothishasla Pvt. Ltd. Allahabad. 4.
- Gorakh Prasad: Integral Calculus, Pothishasla Pvt. Ltd. Allahabad 5.

Mules den på



1. Name of the F	1. Name of the Faculty: Faculty of Science							
2.Course Name	Environmental Science			L	T	Р		
3.Course Code				4	0	0		
4. Type of C	ourse (use tick mark)	Core()	DSE ()	AECC(✓)	SEC()			
5. Pre-requisite	10+ 2 with Science	6.	Even (√)	Odd ()	Either	Every		
(if any)	Stream	Frequen			Sem()	Sem ()		
-8		cy						
		(use tick						
		marks)						
7. Total Number of Lectures, Tutorials, Practicals								
Lectures = 52	Tutorials	= Nil	Practical = N	Til				

8. Course Description:

This course study of environmental problems is inherently interdisciplinary, blending perspectives from the sciences, social sciences, and humanities.

9. Course Objectives:

- 1. To learn the Organizational level of ecological systems
- 2. To understand the scope of environmental sciences in the current scenario.
- 3. To gain the knowledge and impact of various types of pollutions along with their preventive measures.
- 4. To understand the different environmental issues and there social impact.

10. Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

- 1. Know the Importance of environmental studies and methods of conservation of natural resources..
- 2. Describe the structure and function of an ecosystem and explain the values and Conservation of bio-diversity.
- 3. Recall social issues and legal provision and describe the necessities for environmental act
- 4. To describe the impact of various pollutants in society and the parameters to overcome these pollutants.

11. Unit wise detailed content

Unit-1	Number o	of	Title	of	the	unit:-	The	Multidisciplinary	nature	of
	lectures=13		enviro	nme	ental s	tudies.				

The Multidisciplinary nature of environmental studies, Definition, scope and importance. Need for public awareness. Natural Resources, Renewable and non-renewable resources: Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Unit – 2	Number	of	Title of the unit:-	Ecosystems	
Alon	foralik	Aller	plonee body c	S. Leta	the lander



	lectures=13	
Concept of an	ecosystem. Structure an	d function of an ecosystem. Producers, consumers and
decomposers. Ei	nergy flow in the ecosys	stem. Ecological succession. Food chains, food webs and
ecological pyram	ids. Biodiversity and its co	onservation. Hot-spots of biodiversity. Threats to biodiversity:
habitat loss, poac	hing of wildlife, man-wild	life conflicts. Conservation of biodiversity: In-situ and Ex-situ
conservation of b	iodiversity.	
Unit – 3	Number of	Title of the unit: Environmental Pollution
	lectures=13	
Definition, cause	s, effects and control meas	sures of Air pollution, Water pollution, Soil pollution, Marine
pollution, Noise	pollution, Thermal pollutio	on, Nuclear hazards. Solid waste Management: Causes, effects
and control meas	ures of urban and industria	al wastes. Fireworks, their impacts and hazards. Pollution case
studies. Disaster 1	nanagement: floods, earthc	uake, cyclone and landslides.
Unit – 4	Number of	Title of the unit: Social Issues and the Environment
	lectures=13	
Unsustainable to	Sustainable development.	Urban problems related to energy. Water conservation rain
water harvesting,	watershed management.	Resettlement and rehabilitation of people: its problems and
concerns. Case s	tudies. Environmental eth	ics: Issues and possible solutions. Consumerism and waste
products. Environ	mental Legislation (Acts	and Laws) Issues involved in enforcement of environmental
legislation. Huma	in Population and the Env	vironment. Population growth, variation among nations with
case studies, Pop	ulation explosion - Fami	ly Welfare Programmes and Family Planning Programmes
Human Rights, Va	alue Education, Women an	d Child Welfare
12. Brief Descrip	tion of self-learning / E-le	earning component
1. <u>https://ww</u>	w.youtube.com/watch?v=9	OTmZRZ-w1Y4
2. <u>https://ww</u>	w.youtube.com/watch?v=)	YaRkQ6mYNC4
3. <u>https://ww</u>	w.youtube.com/watch?v=b	oCVtowxwqR8
4. <u>https://ww</u>	w.youtube.com/watch?v=v	r-RMhW4Xcyw
5. <u>https://ww</u>	w.youtube.com/watch?v=In	nD80 yGLR0
6. <u>https://ww</u>	w.youtube.com/watch?v=Q	2zP2mnrVdeY
13. Books Recom	mended	
1. Dhameja, S	S. K., Environmental Engir	neering and Management, S. K. Kataria and sons. New Delhi.
1st Edition	2015.	
2. Anubha Ka	ushik and Kaushik C.P., E	nvironmental Science & Engineering" New Age international
Publishers,	New Delhi, 2010.	
3. Gilbert M.	Masters, Introduction to	Environmental Engineering and Science, Pearson Education
Pvt., Ltd., A	2nd edition, 2004.	
4. ErachBhar	icha, Textbook for Enviror	nmental Studies, UGC, New Delhi, 2004.
5. Miller I.G.	Jr., "Environmental Scien	ce", Wadsworth Publishing Co. USA, 2nd Edition2004.
o. ErachBhari	icha, "The Biodiversity of	India", Mapin publishing Pvt. Ltd., Ahmedabad India, 2002.
7. Irivedi R.	K., "Handbook of Env	ironmental Laws", Rules, Guidelines, Compliances and
Standards,	vol. I and II, Enviro media	n, 2003.
o. Cunningna	m, w.P. Cooper, T.H. Go	orhani, "Environmental Encyclopedia", Jaico Publ., House,
Mumbal, 2	001. 7. wager K.D., "Env	ironmental Management", W.B. Saunders Co., Philadelphia,
0 Source C	N MaCarta D I and	
9. Sawyer C. McGraw-H	III. Inc. New York 1004	Parkin G. F., Chemistry for Environmental Engineering,
Micolaw-П	m, me., ivew i ork, 1994.	1 W
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Am h	O.K.	N CO M
JUS	fonce Dela	TX XX
		in a lote any.
		W c.Shell



1. Name of the De	nartment: Chemistry				1		
2. Course Name	General Organic Chemi	istry & Introduction	L	Т		P	
	to Organic Functional Groups		- .				
3. Course Code	17030203		3	0		0	
4. Type of Course	(use tick mark) Coro (1)		DSEO	AECO SECO		GEO	
5 Dro roquisito	NA	6 Engagement	DDL (ALC ()	Eithen	GE ()	
(if any)	INA	(use tick marks)	Even (Som ()	Every	
7 Total Number of	f Lactures Tutorials D	(use tick marks)			Sen ()	Sem (
$\frac{7.10 \text{ tarres}}{1 \text{ octures}} = 40$	n Lectures, rutoriais, r	Tutorials - 0	Dro	atical - 0		-	
8 Course Descript	tion	Tutoriais – 0	114	ctical – U			
The course highlig	hts the various electronic	effects with empha	sis on induct	ive affect	hupercon	ingation	
resonance and how	they affect the propertie	es of compounds N	ucleophilic a	ind electro	nypercon	jugation	
organic compound	s and the intermediates	formed during react	tions: carboo	ations: car	rbanions.	and fre	
radicals will be exr	plained along with stereo	chemistry of organic	compounds	which inv	volves the	study c	
the relative spatial	arrangement of atoms the	at form the structure	of molecule	s will be d	iscussed a	t length	
Various functional	groups of organic chemis	try will also be discu	issed in detail	il	15005500 0	u lengu	
9. Course Objectiv	ves		ussed in detai				
The objectives of th	his course are to:						
1. Introduce the	properties of organic	compounds with	special emr	hasis on	inductive	effec	
hyperconjugati	on and resonance. electro	philicity and nucleo	philicity and	impact of	function	al grour	
on reactions		· · · · · · · · · · · · · · · · · · ·	printenty and	impact of	runetion	Broup	
2. Understand ster	reochemistry of compoun	nds					
3. Learn importan	t properties of various fu	nctional groups.					
10. Course Outcor	nes (COs)					in the second	
Upon successful co	mpletion of this course, t	he student will be ab	le to:				
1. Explain various	s electronic effects and th	eir role in organic re	action mecha	nism.			
2. Learn basics of	stereochemistry						
3. Know about va	rious organic functional g	groups and their prop	perties				
11. Unit wise detai	iled content						
Unit-1 N	Sumber of lectures = 10	Title of the un	it: Fundam	entals of (Organic	and the second	
		Chemistry an	d Stereoche	mistry			
Fundamentals of	Organic Chemistry: Pl	hysical Effects, Elec	ctronic Displ	acements:	Inductive	e Effect	
Electromeric Effect	t, Resonance and Hyperco	onjugation. Cleavage	of Bonds: H	lomolysis	and Heter	olysis.	
Structure, snape	and reactivity of orga	nic molecules: Nu	cleophiles a	ind electr	ophiles.	Reactiv	
Strength of organic	ocations, Cardanions and	a free radicals.	mahasis on	fastana af	Casting all	1	
A romaticity: Banza	acids and Hückel's rule	arative study with e	emphasis on	factors an	tecting pr	values	
Stereochemistry.	Conformations with rest	pact to athona buta	no and aval	ahavana	Intoroonu	mion o	
Wedge Formula N	ewmann Sawhorse and F	Sischer representation	ne and cyclo	of chirality	(up to tw	a corbo	
atoms) Configuration	ion: Geometrical and On	tical isomerism: En	antiomerism	Diastereo	merism a	nd Mes	
compounds). Three	and erythro: D and L: cis	- trans nomenclature	· CIP Rules	R/S (for u	nto 2 chir	al carbo	
atoms) and $E/Z N$	omenclature (for upto two	C=C systems).	, en ruies.		pto 2 chine	ii cai oo	
Unit-2	umber of lectures = 10	Title of the un	it: Alinhatio	Hydroca	rhons		
Aliphatic Hydroc	arbons: Functional gro	up approach for th	e following	reactions	(prepara	tions /	
reactions) to be stud	died in context to their str	ucture.	ie rene ing	, reaction.	propuid		
Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation. Wurtz reaction. Kolhe's synthesis from							
Grignard reagent. Reactions: Free radical Substitution: Halogenation.							
Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and							
dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and							
trans alkenes (Birch reduction). Reactions: cis addition (alk. KMnO ₄) and trans-addition (bromine).							
Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis,							
oxymecuration-demercuration, Hydroboration-oxidation.							
4 7	et the	2 Ash	~				



Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetrahalides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO₄, ozonolysis and oxidation with hot alk. KMnO₄.

Unit-3	Number of lectures = 10	Title of the unit: Alcohols, Phenols and Ethers (Up
1		to 5 Carbons)

Alcohols:

Preparation: Preparation of 1°, 2° and 3° alcohols using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acids and esters.

Reactions: With Sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO₄, acidic dichromate, conc. HNO₃). Oppenauer oxidation

Diols: (Upto 6 Carbons), oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case)

Preparation: Cumene hydroperoxide method, from diazonium salts.

Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben-Hoesch Condensation, Schotten-Baumann Reaction.

Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

Aldehydes and ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde)

Preparation: from acid chlorides and nitriles

Reactions: Reaction with HCN, ROH, NaHSO₃, NH₂-G derivatives. Iodoform test, Aldol condensation, Canizzaro's reaction, Wittig reaction, Benzoin condensation.

Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction.

Unit-4	Number of lectures = 10	Title of the unit: Carboxylic Acids and their
· · ·		derivatives; Amines and Diazonium Salts
	1 2 1 2 11 1	

Functional group approach for the following reactions (preparations and reactions) to be studied in context to their structure.

Carboxylic acids and their derivatives

Carboxylic acids (aliphatic and aromatic)

Preparation: Acidic and Alkaline hydrolysis of esters

Reactions: Hell-Vollhard-Zelinsky Reaction

Carboxylic acid derivatives (Upto 5 carbons)

Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion. Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.

Amines and Diazonium Salts

Amines (Aliphatic and Aromatic) (Upto 5 Carbons)

Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test with HNO₂, Schotten-Baumann Reaction, Electrophilic substitution (case aniline), nitration, bromination, sulphonation.

Diazonium salts

Preparation: from aromatic amines

Reactions: conversion to benzene, phenol, dyes.

12. Brief Description of self-learning/ E - learning component

- 1. http://www.wou.edu/chemistry/files/2017/01/CH105-Chapter-8-PDF-file.pdf
- 2. http://ncert.nic.in/ncerts/l/kech205.pdf
- 3. https://www.utdallas.edu/~scortes/ochem/OChem1_Lecture/Class Materials/09 stereo notes.pdf

13. Books Recommended

- 1. Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. Organic Chemistry, John Wiley & Sons (2014) ISBN 978-1-118-65305-0.
- 2. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013, ISBN 0-495-05101-2.
- 3. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988), ISBN978-8177584332.
- 4. Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000, ISBN



- 9780070992900.

- Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S., ISBN 978-8177585421
 Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010, ISBN,978-8131704813
 Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010 ISBN, 978-8121935159

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ito C 3. Course Code 170 4. Type of Course (use ti 5. Pre-requisite NA (if any) NA 7. Total Number of Lect Lectures = 0 8. Course Description The lab work emphasizes want to pursue any exper detection, and functional g 9. Course Objectives The objectives of this court 1. Detect various extra el 2. Separate mixture by pa 3. Analysis of various or 10. Course Outcomes (CO Upon successful completi 1. Detect heteroatoms (N 2. Separate amino acids a 3. Analyze various funct 11. List of Experiments (Separation of extra elements) 2. Separation of mix two compounds to I dentify and s acid, glutamic • Identify and s acid, glutamic	ures, Tutorials, Pra ures, Tutorials, Pra learning of basic sk rimental science. It i group analysis. rse are to: elements in organic c paper chromatograph rganic functional gro Os) ion of this course, th N, S, Cl, Br, I) in organic and sugars with paper tional groups of orga (Student has to perfinistry-I a elements (N, S, C	Core (√) 6. Frequency (use tick marks) acticals Tutorials = 0 tills helpful not only to includes simple chrow compounds y pups te student will be able anic compounds er chromatography unic compounds form ten experiment	$\frac{0}{\text{DSE ()}}$ Even (\checkmark) to chemistimatograph	AEC () Odd () Practica ry students ic techniq	0 SEC () Either Sem () 1 = 52 hrs s but all th ues, extra n each sec	4 GE () Every Sem (
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 Section B: Organic Chen 3. Purification of org distillation. 4. Criteria of Purity: 5. Preparations: Mech determination of n 6. Bromination of Ph 7. Benzoylation of an 8. Oxime and 2,4-dir 9. Analysis of selected 2. Brief Description of s 	ctures by Chromatog be given) separate the component c acid, tyrosine or an separate the sugars p nistry-II ganic compounds by Determination of me chanism of various re melting point and cal nenol/Aniline mines/phenols nitrophenylhydrazon ed functional groups self-learning/ E – lea	graphy: Measure the ents of a given mixtur by other amino acid) I present in the given m crystallization (from elting and boiling poi eactions involved to b loulation of quantitation e of aldehyde/ketone such as -COOH, -OH arning component	Rf value in re of two a by paper cl ixture by p water and nts. we discusse ve yields to <u>H, -C=O, -</u>	n each cas mino acids hromatogra paper chron alcohol) a d. Recrysta o be done.	e (combin s (glycine, aphy matograph nd allisation,	aspart y.
https://vlab.amrita.edu	1/2sub=2&brch=101	∼=344&cnt=1				
. http://bbec.ac.in/wp-co	ontent/uploads/2015	/08/Practical first-set	mester.ndf			
https://www.macaleste	er.edu/~kuwata/Class	ses/200102/Chem%2	011/Revis	ed%20Am	ino%20A	cids%?
0(9%201%2001).pdf						
https://pubs.acs.org/do	oi/abs/10.1021/ed007	7p724				
3. Books Recommended	1					



- 1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G. ISBN 978-0582462366.
- 2. Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996, ISBN 978-0582462366
- Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960 ISBN 978-8131727102

to SP



1.	1. Name of the Department: Mathematics								
2.	Course Name	Differential	L		Т		Р		
		Equations							
3.	Course Code	17030205	3		0		0		
4.	4. Type of Course (use tick mark)		Co	re (🖋	DSE ()	AEC ()	SEC ()	OE ()	
5.	Pre- requisite (if any)		6.	Frequency (use tick marks)	Even ()	Odd ()	Either Sem ()	Every Sem ()	
7.	Total Number	of Lectures, Tute	orial	s, Practical				1	
Le	Lectures = 40			Tutorials = 0 Practical = 0					
0									

8. Course Description:

Differential equations and their solutions. Linear Differential equation. Homogeneous Differential Equations. Second order linear differential equations. Total differential equations.

9. Course Objectives:

To introduce the basic concept of Differential equations and their solutions. Strength of these concepts in engineering and real world problems will be highlighted.

10. Course Outcomes (COs):

After completing the course, students are expected

- 1. To learn about the basic concept of Differential equations.
- 2. To understand orthogonal trajectory and Homogeneous ordinary differential equation.
- 3. To learn about the basic concept of second order Differential equations.
- 4. To solve the Differential equation by general method.

11. Unit wise detailed content

Unit – 1	Number of lectures =	Title of the Unit: Introduction to Differential
	10	Equations

Order and degree of a differential equation, Linear & Non-Linear differential equations, Homogeneous differential equations, Geometrical meaning of differential equations (DE), Exact differential equations, Integrating factors, First order higher degree differential equations solvable for x, y, p, Lagrange's differential equations, Clairaut's equations, Equations reducible to Clairaut's form, Singular solutions of differential equations.

Unit - 2	Number of lectures =	Title of the unit: Orthogonal Trajectories and
	10	Homogeneous DE

Orthogonal trajectories in cartesian coordinates and polar coordinates, Self-orthogonal family of curves, Linear differential equations with constant coefficients, Homogeneous linear differential equations, Cauchy's differential equations.

Unit -	Number of lectures = 10	Title of the unit: Linear DE and Non-homogeneous
3	1	DE

Linear DE of second order with variable coefficients: Reduction to normal form, Method of undetermined coefficients, Transformation of the equation by changing the dependent variable/independent variable, Solution by operators of non-homogeneous linear DE, Reduction of order of a DE

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Unit - 4	Number of lectures =	Number of lectures = Title of the unit: General Methods to solve DE and								
	10	Solutions of Simultaneous DE and Total DE and								
and the second	Methods									
Method o	Method of variations of parameters, Ordinary simultaneous DE, Solution of simultaneous DE									
involving	operators x (d/dx) or t (d/dt)	etc, Simultaneous equation of the form $dx/P=dy/Q=dz/R$.								
Total DE	, Condition for Pdx+Qdy=Rd	z=0 to be exact, General method of solving								
Pdx+Qdy	+Rdz=0 by taking one variat	ble constant, Method of auxiliary equations.								
12. Brief	Description of self-learning	g / E-learning component								
1. https	://nptel.ac.in/courses/111/10	6/111106100/								
2. https	://nptel.ac.in/courses/111/10	7/111107111/								
13. Book	s Recommended									
1. A.I	R. Forsyth, A Treatise on Dif	ferential Equations, Macmillan and Co. Ltd. London								
195	56.									
2. E.A	A. Codington: An Introduction	on to Differential Equations, Dover1961.								
3. S.L	. Ross: Differential Equatio	ns (3rd edition). John Wiley & Sons 2004.								

B. Rai and D.P. Chaudhary: Ordinary Differential Equations: An Introduction; Narosa, Publishing House Pvt. Ltd, 2019. 4.

Markin Amalik

Job c. s. halike



1. Name of the De	epartment: Math	nematics	Sector C			
2. Course Name	Differential	L		Τ		P
	Equations Lab					
3. Course Code	17030206	0		0		4
4. Type of Course mark)	e (use tick	Core (🖋	DSE ()	AEC ()	SEC O	OE ()
5. Pre-requisite (if any)		6. Frequency (use tick	Even (Odd ()	Either Sem	Every Sem
7 Total Number	of Lactures Tut	marks)				
$\frac{7.10 \text{ array}}{100 \text{ array}} = 0$	of Lectures, Tub	Tutorials -	0	Direction -	- 52	
8 Course Descrir	otion.	1 utoriais –	U	1 Tactical -	- 34	
This course is desi	igned to omnhasi	ize the knowledge	a of diffor	antial aquat	ione Em	. to a to
This course is desi	igned to emphasi	ize the knowledg	e of differ	ential equat	ions. Em	phasis
placed on different	t forms of linear	and non-linear of	lifferential	equations.	Upon co	mpletio
students should be a	able to write the p	rograms in MATI	LAB or othe	er software.		
9. Course Object	tives:					
1. Give an account	nt of basic concep	ots and definitions	for differen	ntial equatio	ns;	S. S
2. Use methods f	for obtaining exac	ct solutions of lin	ear homog	eneous and	non-hom	ogeneo
differential equ	uations;	· · · · ·				U
3. Describe some	e simple numeric	al solution techni	ques and h	be familiar y	with mat	nematic
software for di	ifferential equation	ns [.]	ques une c		i initi initian	lematic
4 Use elementar	v methods for line	ar systems of diff	Corontial ag	untions		
10 Course Outcom	y memous for mix	al systems of uni	erentiai equ	uations.		-
10. Course Outcon	nes (COs):			1 1.0		
After completing th	he course, studen	its are expected to	o be able t	to solve diff	erential e	equation
analytically.						
11. The list of pract	icals to perform in	n the computer lab).			
1. Solve a diff	erential equation	analytically by u	sing the ds	olve function	n, with o	r witho
initial condit	tions.			· · · · · · · · · · · · · · · · · · ·		
2. To solve a s	vstem of different	tial equations.				
3. To solve firs	st order Linear OI	DE				
4 To solve Fir	st order linear dif	ferential equations				
5 To solve firs	st order Bernoulli	equations				
5. To solve ms	E with initial and	equations				
o. To solve OL	DE with initial cor	aitions		100		
7. To solve No	nlinear differentia	al equations with i	nitial condi	itions		
8. To solve sec	ond order ODE w	with initial condition	ons			
9. To solve a s	ystem of Ordinary	differential equa	tions			
10. To find the e	explicit solution o	f first order differ	ential equat	tions		
11. To find the e	explicit solution o	f second order dif	ferential eq	uations		
12. Brief Description	on of self-learnin	g / E-learning co	mponent			
1. https://www	mathworks.com/	help/symbolic/sol	ve-a-single	-differential	equation	html
2 https://in ma	thworks com/hel	/symbolic/solve-	-system of	f differentia	equation	a html
3 https://refere	ance wolfram cor	/language/tutorial	/DSalvalat	raduction b	-cyuation	<u>15.11(1111</u>
12 Pools Decembr	and ad	Manguage/tutoria	DSolverin			
1. D. D. I		DICI	1.1.1.1.1		0. 11	** •
1. Barnes, Beli	nda &Fulford, Gl	enn R. Mathemati	cal Modell	ing with Cas	seStudies.	, Using
Maple and M	ATLAB (3 ^{ra} edit	tion). CRC Press,	Taylor & F	rancis Grou	p, 2015.	
2. C. P. López,	MATLAB Differ	rential Equations,	Apress, 20	14.		1111
3. Dingyü Xue	e, Differential Equ	uation Solutions w	ith MATL.	AB, De Gru	yter, 2020).
4. Brian R. Hu	nt, Ronald L. Lips	sman, John E. Osł	orn, Donal	d A. Outing	, Jonatha	n
Rosenberg, 1	Differential Equat	tions with Mathem	natica (3 rd	edition). Joh	n Wiley	& Sons
(2009)	1		(° .	, , , , , , , , , , , , , , , , , , , ,	in ney (
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N	J.V.	1	/	1		
N/ ma	V		(Lalte		



SEMESTER-III (CORE)



1.1	Name of the De	partment: Physics							
2.	Course Name	Thermal Physics and Statistical Mechanics	Chermal PhysicsLand StatisticalMechanics		Т		Р		
3.	Course Code	17030301		3			0		0
4.	I. Type of Course (use tick mark)		Co	re (√)	DSE	C ()	AEC ()	SEC ()	GE ()
5.	Pre-requisite (if any)		6.	Frequency (use tick marks)	Even	0	Odd (√)	Either Sem ()	Every Sem ()
	Total Number	r of Lectures, Tutor	rials,	Practical					
2	ectures = 40			Tutorials	= 0 Practical = 0				
3.	Course Descr	iption:	2			1			
8. Th	Course Descr e course will de	iption: eepen your understar	nding	of basics of	thermo	odyn	namic princ	ciples, ther	modyna

9. Course Objectives:

The objectives of this course are

potentials, and the kinetic theory of gases.

- 1. To study the different laws of thermodynamics and their practical applications.
- 2. To define the thermodynamic potentials and derive the Maxwell's equations.
- 3. To study the transport phenomena in the gases.
- 4. To study the three different statistics and differentiate between them.

10. Course Outcomes (COs):

After completion of this course, students will have understanding of

- 1. The laws of thermodynamics and will be able to apply them in day to day life.
- 2. Maxwell's relations and will be able to apply it to calculate specific heats, Joule coefficient etc.
- 3. Distribution of velocities and its experimental verification.
- 4. Classical and Quantum mechanics and their comparison.

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Title of the unit: Thermodynamic Description	
		of system	

Zeroth Law of thermodynamics and temperature, First law and internal energy, various thermodynamical processes, work done during isothermal and adiabatic processes, reversible & irreversible processes, Carnot's cycle & theorem, Carnot Engine and its Efficiency, Refrigerator and its Efficiency. Entropy changes in reversible & irreversible processes, Second law & Entropy,




Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero temperature.

Unit - 2 Number of lectures = 10 Title of the unit: Thermody	ynamic Potentials
--------------------------------------------------------------	-------------------

Extensive and Intensive Thermodynamic Variables. Thermodynamic Potentials U, H, F and G : Their Definitions, Properties and Applications, Maxwell's thermodynamic relations & applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for $(C_P - C_V)$, C_P/C_V , T.dS equations.

Unit - 3	Number of lectures = 10	Title of the unit: Kinetic Theory of Gases
----------	-------------------------	--------------------------------------------

Derivation of Maxwell's law of distribution of velocities andits experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Mean, RMS and Most Probable Speeds. Degrees of Freedom.Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

Unit - 4	Number of lectures = 10	Title of the unit: Statistical Mechanics
----------	-------------------------	------------------------------------------

Basics of probability, Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law, limitations of classical statistical mechanics - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.

12. Books Recommended:

1. Thermal Physics, S, Garg, R, Bansal and C, Ghosh, 1993, Tata McGraw-Hill, ISBN: 9781259003356

2. A Treatise on Heat, Meghnad Saha, and B,N, Srivastava, 1969, Indian Press, ISBN: 978-0856550683

3. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications, ISBN: 978-0486603612

4. Heat and Thermodynamics, M,W,Zemasky and R, Dittman, 1981, McGraw Hill, ISBN: 978-0070170599

5. Thermodynamics, Kinetic theory & amp; Statistical thermodynamics, F,W,Sears & amp; G,L,Salinger, 1988,ISBN: 978-8185015712

6. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole, ISBN: 978-0534369644

7. Thermal Physics, A, Kumar and S,P, Taneja, 2014, R, chand Publications, ASIN : B08F7MCVH1

13. links

1. https://nptel.ac.in/courses/103103036/9

2. https://courses.physics.ucsd.edu/2010/Spring/physics210a/LECTURES/210_COURSE.pdf

3. <u>https://ocw.mit.edu/courses/chemistry/5-60-thermodynamics-kinetics-spring-2008/lecture-notes/5_60_lecture1.pdf</u>

4. <u>https://ocw.mit.edu/courses/chemistry/5-60-thermodynamics-kinetics-spring-2008/lecture-notes/5_60_lecture10.pdf</u>

5. <u>https://ocw.mit.edu/courses/chemistry/5-60-thermodynamics-kinetics-spring-2008/lecture-notes/5_60_lecture8_9.pdf</u>

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2 Course Name	Thermal	L	T	Т		Р
2. Course reame	Physics and Statistical					
3. Course Code	17030302	0		0		4
4. Type of Cours	se (use tick mark)	Core (√)	DSE 0	AEC 0	SEC ()	GE ()
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	$\begin{array}{c} \text{Odd} \\ () \end{array}$	Either Sem ()	Every Sem()
7. Total Number	of Lectures, Tuto	rials, Practical			•	
Lectures = 0		Tutorials = 0	Prac	ctical = 5	2	
8. Course Descri	iption:					
The experiment ha conduction of heat	s been designed in s through metals and	such a way the st l use of potentio-	udent can meter fore	learn abo calibrati	out thermo- on etc.	electric effect,
9. Course Object	ctives:			- A		
 To understathermocoup Students woof thermod 	and the working prin ple. ill learn about the va ynamics	nciples of thermo arious processes	ocouples an of transmi	nd variou ssion of l	es effects as	sociated with
3 Students w	ill be able to calcula	ate the optical pa	rameters			
 Students w 	ill learn about optic	ally active substa	ances			
10. Course Outco	mes (COs):					
After successful co	ompletion of the cou	urse students wil	l be able to	0		<u> </u>
1. Apply the othermocoup	concepts of basic the ples for daily life ap	ermodynamics proplications such a	rinciple to s a refrige	design th rator, coc	e different bling etc.	type's
2. Correlate th	he theoretical conce	pts with the expe	erimental o	ones		
3. Acquire an	d analyze the exper-	imental data				
4. 4. To calcu	late one parameter	using different ex	perimenta	ıl techniq	ues	
11. List of Experi	ments					
1. To study temperatur	the variation of the.	nermo emf acro	ss two ju	inction o	of a thermo	o couple with
2. To determi	ne the coefficient o	f thermal conduc	tivity of co	opper by	Searl's app	aratus.
3. To determi	ne mechanical equi	valent of heat by	Callender	and Barn	ie's constan	t flow method
		AND .	ord	t	y	×),



- 4. Calibration of a thermocouple by potential meter.
- To calculate probability distribution function using MATLAB/Python. 5.
- To study the random walk using MATLAB/Python. 6.
- 7. To study the Brownian motion using MATLAB/Python.
- 8. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
- 9. Comparison of Illuminating Powers by a Photometer.

10. Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter.

12.Book Recommended

- Advanced Practical Physics for students, B.L. Flint & H.T. Worsop, 1971, Asia Publishing 1. House, ISBN: 978-0423738902
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab 2. Mahal, New Delhi, ISBN: 978-8122500844
- Engineering Practical Physics, S. Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. 3. Ltd., ISBN: 978-8131525203

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1. Name of the D	epartmen	t: Chemistry					141 N 199
2. Course Name	States of Chemist	f Matter, Thermory of Organic Fu	odynamics and unctional Groups	L	T	Р	1.5.
3. Course Code	1703030	13	$\mathcal{T} = \{ f_{i}, f_{i} \}$	3	0	0	
4. Type of Course	e (use tick	k mark)	Core (✓)	DSE ()	AEC ()	SEC ()	GE ()
5. Pre-requisite (if any)	NA		6. Frequency (Use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem (
7. Total Number	of Lectur	es, Tutorials, P	ractical	1			
Lectures = 40		Tutorials = 0		I	Practical =	0	
8. Course Descri	otion					S	
This course will g	ive an exc	ellent opportuni	ity to study and use	the knowle	edge of Gas	eous State	e, Liquic
State, Solid State,	thermody	namics and solut	tions. In organic chei	nistry, pre	paration an	d reactions	s of ethe
and epoxides, ami	no acids, j	peptides and pro	teins; and carbohydi	rates will b	be discussed	1.	
9. Course Object	ives						
The objectives of	this course	e are to:					
1. Introduce stud	lents to the	e chemistry of g	aseous, liquid and so	olid states	of matter.		
2. Introduce stud	lents to the	ermodynamics o	of ideal solutions and	Raoult's	law		
3. Familiarize sti	idents wit	h principles gov	erning miscibility of	t liquids			
4. Explain phase	diagrams	of one compone	ent system (water an	d Sulphur) and two c	omponent	systems
(PD-Ag, FeCl3	-H ₂ O and	Na-K) involvin	g eutectics, congrue	nt and inco	ongruent me	elting poin	ts
5. Explain prepa	ration and	reactions of eth	er, epoxides, amino	acids, pep	tides and pl	roteins; an	d
10 Course Outer	mos (CO	e)		•			<u>.</u>
Lipon successful c	ompletion	of this course	the student will be a	hle to:			
1 Understand t	ne chemist	try of Gaseous	iquid and Solid stat	tes			
 Understand th Understand th 	ne behavio	or of ideal solution	ons and Raoult's law	v and devi	ations from	Raoult's	211/
3 Explain phase	e diagram	s for selected on	e component and tw	o compon	ent systems	Rabuit 51	aw
4 Explain prep	aration and	d reactions of et	her and enoxides an	nino acids	nentides a	nd protein	s and
carbohydrate	S.		nor and eponices, an	into actas,	peptides u	iu proteini	s, and
11. Unit wise deta	ailed cont	ent					
Section A: Physic	al Chemi	stry (20 Lectur	es)				
Unit-1	Numb	er of lectures =	10 Title of the	unit: Stat	te of Matte	r	
Gaseous State: Po	ostulates o	of Kinetic Theor	y of Gases and deriv	ation of th	e kinetic ga	as equation	1.
Deviation of real g	gases from	ideal behaviour	r, compressibility fac	ctor, cause	s of deviati	on. van de	er Waals
equation of state f	or real gas	ses. Boyle tempe	erature (derivation no	ot required	l). Critical c	onstants a	ind their
calculation from v	an der Wa	als equation. M	axwell Boltzmann d	istribution	laws of mo	olecular ve	locities
and molecular ene	rgies (gra	phic representati	ion – derivation not	required) a	and their im	portance.	
Temperature depe	ndence of	these distribution	ons.				
Liquid State: Sur	face tensio	on and its determ	nination using stalag	mometer.	Viscosity c	of a liquid	and
determination of c	oefficient	of viscosity usin	ng Ostwald viscome	ter. Effect	of tempera	ture on su	rface
tension and coefficient	cient of vi	scosity of a liqu	id (qualitative treatn	nent only).	and the second		
Solid State: Form	s of solids	s. Symmetry eler	ments, unit cells, cry	stal system	ns, Bravais	lattice typ	es and
identification of la	ittice plane	es. Laws of Crys	stallography - Law o	of constance	y of interfa	cial angles	s, Law
of rational indices	. Miller in	dices. X-Ray di	ffraction by crystals	, Bragg's	law. Structu	ires of Na	CI, KCI
and CSCI (qualitat	ive treatm	ent only). Defec	ts in crystals. Glasse	es and liqu	id crystals.		
Unit-2	Numb	er of lectures =	10 Title of the	unit: The	rmodynan	nics	1
I nermodynamics	of ideal sc	olutions: Ideal so	olutions and Raoult's	s Law, dev	iations from	n Raoult's	law-
non-ideal solution	s. vapour	pressure-compo	sition and temperati	ure-compo	sition curve	es of ideal	and
non-ideal solution	s. Distillat	Critical solutions	. Lever rule. Azeotro	opes.			
Partial miscibility	of inquids	: Critical solutio	n temperature, effec	t of impur	ity on partia		ity of
inquids. Immiscib	inty of hq	ulds- Principle (of steam distillation,	Nernst dis	stribution la	w and its	
Phases component	it extraction	un.	of a system anitari	of phase	aquilibrium	Cibba DI	
Pule and its them	adunamia	derivation Dar	ivotion of Clausius	Clanguage	equilibrium	d ita ima	lase
Rule and its therm	ouynamic	derivation. Der	Ivation of Clausius-	Clapeyron	equation a	id its impo	ortance
b		Aby	~ Ast	N	0	/	

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in phase equilibria. Phase diagrams of one-component systems (water and Sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, FeCl₃-H₂O and Na-K only)

Section	Section B: Organic Chemistry (20 Lectures)					
Unit-3	Number of lectures = 10	Title of the unit: Ethers, Epoxides, and				
		Carbohydrates				
Ethers	and Epoxides: Preparation and reactions	with acids; Preparation of ether by dehydration of				
alcoho	ls and by Williamson Synthesis. Reaction	ns of epoxides with alcohols, ammonia derivatives and				
lithium	n aluminium hydride.					
Carboh	hydrates: Classification, and General Proj	perties, Glucose and Fructose (open chain and cyclic				
structu	rre), Determination of configuration of m	onosaccharides, absolute configuration of Glucose and				
Fructos	se, Mutarotation, ascending and descendi	ng in monosaccharides. Structure of disaccharides				
(sucros	se, maltose, lactose) and polysaccharides	(starch and cellulose) excluding their structure				
elucida	ation. Glycosylation Reactions.	· · · ·				
Unit-4	No. of Lectures = 10 Tit	le of the unit: Amino acids, Peptides and Proteins				
Prepara	ation of Amino Acids: Strecker synthesis	using Gabriel's phthalimide synthesis. Zwitterion.				
Isoelec	ctric point and Electrophoresis.	8				
Reactio	ons of amino acids: ester of -COOH grou	p. acetvlation of -NH ₂ group, complexation with				
Cu ²⁺ io	ns, ninhvdrin test	F,				
Overvi	iew of Primary, Secondary, Tertiary and	Ouaternary structure of proteins				
Determ	nination of primary structure of peptides	by degradation. Edmann degradation (N-terminal) and				
C-term	ninal (thiohydantoin and with carboxyper	tidase enzyme).				
Synthe	esis of simple peptides (upto dipeptides) b	by N-protection (t-butyloxycarbonyl and phthaloyl) and				
C-activ	vating groups and Merrifield solid-phase	synthesis.				
12. Bri	ief Description of self-learning/ E – lea	rning component				
1.	https://voutu.be/suUaAJVvGXI					
2.	https://nptel.ac.in/courses/113106032/9	%20-%20Phase%20diagrams.pdf				
3.	http://chemistry2.csudh.edu/rpendarvis/	/aminrxn.html				
4.	https://olemiss.edu/courses/bisc102/ma	cromol.html				
5.	https://www.google.com/url?q=https://c	drive.google.com/open?id%3D1z9E0o8y0prgSNfUS2d				
1.19	NHUL2qYOGmDqOh&sa=D&ust=15:	55314141234000&usg=AFQjCNEx62Pf-				
	Ce1gLbpmSZClBkKLwBixQ					
6.	http://uou.ac.in/sites/default/files/slm/B	SCCH-103.pdf				
13. Bo	oks Recommended					
1.	Castellan, G.W. Physical Chemistry 4th	n Ed. Narosa (2004), ISBN-13: 978-8185015590				
2.	Kotz, J.C., Treichel, P.M. & Townsend	, J.R. General Chemistry, 1 st Edition, Cengage Learning				
	India Pvt. Ltd.: New Delhi (2009), ISBI	N: 9788131508442				
3.	Morrison, R.T. & Boyd, R.N. Organic (Chemistry, 6 th Edition, (2016) Pearson India, ISBN:				
	978-8177581690					
4.	Finar, I.L. Organic Chemistry (Volume	1), 6th Edition, Pearson Education India, ISBN:				
	9788177585421					
5.	Nelson, D.L. & Cox, M.M. Lehninger's	s Principles of Biochemistry, 2017, 7th Ed., W.H.				
	Freeman, ISBN: 978-1464187964					
6.	Berg, J.M., Tymoczko, J.L. &Stryer, L.	Biochemistry, W. H. Freeman; Fifth Edition (February				
1	15, 2002), ISBN: 978-0716746843.					
7.	B.S. Lark & Silby Joseph, States of mat	tter physical chemistry, VISHAL PUBLISHING CO.,				
-	2013, ISBN: 978-8192143248					

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2. Course Name	States of Matter, Thermody	namics and	L	Т		P
	Chemistry of Organic Fund	ctional Groups Lab				
3. Course Code	17030304		0	0		4
4. Type of Course	e (use tick mark)	Core (√)	DSE ()	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even ()	(\mathbf{V}) bbO	Either	Every
(if any)		(use tick marks)		0.00(1)	Sem ()	Sem (
7. Total Number	of Lectures, Tutorials, Pra	cticals			in the second second	1.11
Lectures = 0		Tutorials = 0		Practical	= 52 hrs.	
8. Course Descri	otion					
The lab work emp want to pursue any	hasizes learning of basic skil y experimental science. It inc	lls helpful not only to cludes surface tensio	o chemistr n and visc	y students b osity measu	ut all those rements; si	who tudying
equilibria by distri	bution methods; construction	n of the phase diagra	um of a bir	hary system	and determ	ining its
critical temperatur	e and composition; qualitativ	ve analysis of organi	c compou	nds; simple	chromatog	raphic
techniques; and m	iscellaneous experiments in o	organic chemistry, e.	.g., titratio	n of glycine	and deterr	ninatior
of its concentratio	n, studying the action of saliv	vary amylase on star	ch, and di	tterentiating	between a	reducir
Q Course Object	ugar.					
1 To nonfer	novnoviment en surfass t	ion and size it				
2 To stude t	he equilibrium of colorted	sion and viscosity	on mother 1			
2. TO study t	ion of phase diagram of a hir	actions by distribution	on method	sing applies	01100000	4
determina	tion of critical temperatures	and composition	calectic) u	sing coonng	curves and	u
4 Perform a	ualitative analyses of selecte	d organic compound	le nossessi	ng monofun	ctional gro	unc
5. Separation	of amino acids by paper chi	romatography	13 possessi	ing monorum	cuonai gio	ups
6. Titration of	of glycine and determination	of its concentration				
7. To study t	he action of salivary amylase	e on starch				
8. Performin	g the experiments to differen	ntiate between a redu	cing and a	nonreducin	g sugar	
10. Course Outco	mes (COs)				0	
Upon successful c	ompletion of this course, the	student will be able	to:			
1. Calcu	late surface tension and visco	osity of the given sar	nple.			
2. Expla	in the equilibrium of selected	d reactions by distrib	ution meth	nod		
3. Constr	ruct phase diagrams of binary	y systems (simple eu	itectic) wit	th cooling cu	urves and d	etermin
critical pa	rameters					
4. Perfor	m the qualitative analyses of	f selected organic co	mpounds p	possessing n	nonofunctio	onal
group	S					
5. To sep	parate the amino acids by par	per chromatography				
6. To det	termine the glycine concentra	ation				
7. Explai	in the action of salivary amy	lase on starch				
One 0. 11 11 11	monta (Student has to norf	nd a non-reducing su	ugar			
Section A. Dhysic	al Chemistry	orm ten experiment	is – at lea	st two from	each secti	on)
Surface tension n	an Chemistry neasurement (use of organiz	c solvents evoluded				
a. Determinat	ion of the surface tension of	a liquid or a dilute	olution usi	no a stalaon	ometer	
b. Study of th	e variation of surface tension	of a detergent solut	ion with c	oncentration	iometer.	
Viscosity measure	ement (use of organic solve	nts excluded)	ion with C	oncentration		
a. Determina	tion of the relative and absol	lute viscosity of a lig	uid or dih	ate solution	using an O	stwald'
viscomete	r.	, , , , , , , , , , , , , , , , , , , ,			un of	
b. Study of the	he variation of viscosity of an	n aqueous solution w	ith concer	ntration of so	olute.	
Distribution						
a. Study of t	he equilibrium of one of the	following reactions l	by the dist	ribution met	hod:	
I ₂	$(aq) + I^{-}(aq) \longrightarrow I_{3}^{-}(aq)$					
Cu	$^{2+}(aq) + xNH_3(aq) \longrightarrow [C]$	$Cu(NH_3)_x]^{2+}$				
Phase equilibria						
a. Constructio	on of the phase diagram of a l	binary system (simpl	le eutectic) using cooli	ng curves.	•
1	Aton	Ast.	lot			



- b. Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.
- c. Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature.

Section B: Organic Chemistry

- a. Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (amines, amides, ether, epoxide, aldehydic, nitro) and preparation of one derivative.
- b. Separation of amino acids by paper chromatography
- c. Determination of the concentration of glycine solution by formylation method.
- d. Titration curve of glycine
- e. Action of salivary amylase on starch
- f. Effect of temperature on the action of salivary amylase on starch.
- g. Differentiation between a reducing and a non-reducing sugar

12. Brief Description of self-learning/ E - learning component

- 1. https://www.youtube.com/watch?v=qvUyVrUb8Fo&t=543s
- 2. https://www.youtube.com/watch?v=68bo-h3Kf7s&t=2s
- 3. https://www.youtube.com/watch?v=uto6OlbBwEo
- 4. https://nptel.ac.in/courses/103104129
- 5. https://www.youtube.com/watch?v=ZCzgQXGz9Tg

13. Books Recommended

- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Pearson; 5th edition (February 19, 1996), Prentice-Hall, 5th edition, ISBN-13: 978-0582462366.
- 2. Mann, F.G. & Saunders, B.C., Practical Organic Chemistry, 4th Edition, Pearson Education India; 4th edition (1 January 2009), ISBN-13: 978-8131727102.
- 3. Experimental Physical Chemistry by Mathur, Parul; Athawale, 1st Edition, ISBN: 9788122413366
- 4. Khosla, B. D., Garg, V. C., Gulati, A., Senior Practical Physical Chemistry, R. Chand & Company: 18th edition, ISBN: 978-8180450792.



1. Name of the Department: Mathematics							
2. Course Name	Analysis-I	L	Т		I)	
3. Course Code	17030305	3		(0	()
4. Type of Course (us	se tick mark)	Core (✔)	DS	E ()	AEC ()	SEC ()	OE ()
5. Pre-requisite		6. Frequency	Eve	en ()	Ddd	Either	Every
(if any)		(use tick marks)			ouu	Sem ()	Sem()
					(1)		
7. Total Number of L	ectures, Tutorial	s, Practical					
Lectures = 40		Tutorials = 0		Practi	cal = 0		
8. Course Description	8. Course Description:						
This course covers some fundamental topics of mathematical analysis. In this course the students will be taught convergence and divergence of the sequence and series, continuity and differentiability of real valued function, the theory of functions of complex variables, analytic and harmonic functions and their properties, Integration of complex functions, Cauchy Integral theorem and formula.							
9. Course Objectives	5:						

Students that successfully complete this course will be able to:

- 1. Learn to find limit points, interior point, isolated, continuity and differentiability of real veiled functions.
- 2. study on convergence and divergence of sequences and some important tests.
- 3. study on the continuity and differentiability of complex valued function, C-R equation and analytic functions.
- 4. solve definite integrals, Contours and Contour integrals of complex valued functions.

10. Course Outcomes (COs):

After completing the course, students are expected to be able:

- 1. To understand the concept of limit points, open sets, closed sets, interior of a set, closure of a set in Real numbers.
- 2. To know the basics of sequences and series and discuss the convergence using various tests of convergence.
- 3. To evaluate analyticity, differentiability and continuity of complex valued function and discuss the applicability of complex function in flow equation.
- 4. To understand the concept of exponential function, logarithmic function, trigonometric function and apply the methods of complex analysis to evaluate definite integrals.

11. Unit wise detailed content

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Unit – 1 Number of lectures = 08 Title of the unit: Continuity and Differentiability

Real line, bounded sets, intervals, Boundedness of set of real numbers, Supremum and infimum, Neighborhoods, interior points and isolated points, Limit points, Bolzano-Weierstrass theorem, continuity and differentiability of real valued function, Rolle's theorem, Mean value theorem, Intermediate value theorem.

Unit – 2 Number of lectures = 12 Title of the unit: Sequences and Series

Real sequence, Subsequences, Divergent sequence, Bounded sequence, Cauchy sequence, Convergence and divergence of infinite series, Comparison tests, Cauchy's general principle of convergence of series, Auxiliary series or *p*-series, D-Alembert's ratio test, Rabbe's test, Logarithmic test, Cauchy Root test, Cauchy Integral test, absolute and conditional convergence.

Unit – 3 Number of lectures = 12 Title of the unit: Analytic Functions

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Functions of complex variable, Mappings; Mappings by the exponential function, Limits, Theorems on limits, Continuity, Derivatives, Differentiation formulae, Cauchy-Riemann equations, Sufficient conditions for differentiability; Analytic functions and their examples, Harmonic functions.

Unit – 4 Number of lectures = 08 Title of the unit: Elementary Functions and Integrals

Exponential function, Logarithmic function, Trigonometric function, Derivatives of complex valued functions, Definite integrals of complex valued functions, Contours, Contour integrals and its examples, Upper bounds for moduli of contour integrals.

12. Brief Description of self-learning / E-learning component

- 1. https://www.youtube.com/watch?v=md5UCR7mcIY
- 2. <u>https://www.youtube.com/watch?v=7iBqrqHA1oQ&list=PLbMVogVj5nJS_i8vfVWJG16mPcoE</u> <u>KMuWT&index=8</u>

13. Books Recommended

- 1. T.M. Apostol: Mathematical Analysis, Narosa Publishing House (2nd edition), 2002.
- 2. R.R. Goldberg: Methods of Real Analysis, Oxford & IBH publishing Co., 2020.
- 3. D. Somasundaram and B. Choudhary: A First Course in Mathematical Analysis, Narosa Publishing House, 1997.
- 4. Shanti Narayan: A Course of Mathematical Analysis, S. Chand & Co, 2005.
- 5. Shanti Narayan: Theory of Functions of a Complex Variable, S. Chand & Co, 2005.

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2.	Course Name	Analysis I Lab	L		T		P
3.	Course Code	17030306	0		0		4
4.	Type of Course mark)	(use tick	Core (🖋	DSE ()	AEC ()	SEC ()	OE ()
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd ()	Either Sem ()	Every Sem (
7.	Total Number o	f Lectures, Tu	torials, Practical				
Le	ctures = 0	tion:	Tutorials =	= 0	Practical	= 52	
Th En Up 9.	is course is design phasis is placed con completion, str Course Objectiv	ned to enhance on checking con udents should b ves:	e the knowledge ntinuity, differenti be able to write the	of student ability, ana programs	ts using the alyticity using in MATLA	e analysis ng graphs AB or othe	practic and lim r softwa
	Students that succ	essfully comple	ete this course wil	l be able to):		
	1. To compute the	e limit of functi	ons and sequences	s.			
	2. To check for co	ontinuity, differ	entiability using g	graphs.	and		
	4 To plot elemen	tary functions	and complex value	ed function	s		
10.	. Course Outcom	es (COs):	<u> </u>				
2	Mathematica. 2. To demonstrate 3. To evaluate MATLAB. 4. To visualize co	e convergence analyticity, di omplex valued	of series and to fir fferentiability an functions graphica	nd the sum d continu Illy by MA	of the sequence of the sequenc	ence by M nplex fur	[ATLA] actions
11.	. Unit wise detaile	ed content					
Us	ing both MATLA	B and Mathema	atica:				
1	1. To find the rig	ht hand limit, l	eft hand limit of a	function.			
2	2. To check for c	continuity and d	lifferentiability of	functions u	using graph	s.	
3	3. To find deriva	tives using lim	its.				
4	4. To find the lin	nit of a sequence	e.				
5	5. To find the sum of a convergent series.						
e	6. To verify the Cauchy Riemann equations.						
7	7. To find the derivatives of elementary functions						
8 To find the definite integral of functions							
	0. To plot exponential logarithmic and trigonometric functions.						
1	10 To viewaliza	omploy volued	functions areashing		5115.		
	10. To visualize c	omplex valued	functions graphica	ally.			
9	r ha	Pilk .	10	/.	1	te	



12. Brief Description of self-learning / E-learning component

- 1. <u>https://www.youtube.com/watch?v=WmHs1-hWPNs</u>
- 2. <u>https://www.youtube.com/watch?v=ySqevAKo_tc</u>
- 3. https://www.youtube.com/watch?v=6ywCkiAaVd8

13. Books Recommended

- 1. Amos Gilat: MATLAB: An Introduction with Applications (8th edition), John Wiley & Sons Inc, 2016.
- 2. S. Wolfram: The Mathematica book (5th edition) Cambridge: Cambridge University Press, 2003.

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SEMESTER-IV (CORE)



1.	Name of the De	partment: Physics					
2.	Course Name	Waves and Optics	L		Т		Р
3.	Course Code	17030401	3		0		0
4.	Type of Course	(use tick mark)	Core $()$	DSE ()	AEC ()	SEC ()	GE ()
5.	Pre-requisite (if any)		6. Frequen cy (use tick marks)	Even (√)	Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical

Lectures = 40	Tutorials = 0	Practical = 0	
8. Course Description:			

The course will teach about different types of simple harmonic motion and their superposition, flow of fluids, free forced and resonant oscillation and the phenomenon of interference, diffraction and polarization.

9. Course Objectives:

To impart knowledge about harmonic oscillations, and their superposition, various fluids phenomenon, propagation of sound, and different optical phenomenon.

10. Course Outcomes (COs):

After completion of this course, students will have understanding of

- 1. Harmonic Oscillator, Superposition of Two Perpendicular Harmonic Oscillations, Wave motion and Sound
- 2. Phenomenon and application of Fluids
- 3. Wave Optics, Interference and Michelson's Interferometer
- 4. Understanding of Diffraction and Polarization.

11. Unit wise detailed content

Unit-1 Number of lectures = 10 Title of the unit: Harmonic oscillations

Superposition of Two Perpendicular Harmonic Oscillations: - Introduction to Simple Harmonic Oscillations, Superposition of Two Mutually Perpendicular Simple Harmonic Motions with Frequency Ratios 1:1 and 1:2 using Graphical and Analytical Methods. Lissajous Figures and their uses.

Waves Motion- General: Transverse waves on a string, Travelling and standing waves on a string, Normal Modes of a string, Group velocity, Phase velocity, Relation between phase velocity and group velocity, Wave intensity,

Sound: Forced vibrations and resonance, Fourier's Theorem (Application to saw tooth wave and square wave), Characteristics of sound, Musical sound and noise, musical scale, Acoustics of buildings: Reverberation and time of reverberation, Sabine's formula.

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Unit – 2 Number of lectures = 10 Title of the unit: Fluids



Fluids: Surface Tension, Excess pressure, Application to spherical and cylindrical drops and bubbles, variation of surface tension with temperature, Jaeger's method, Viscosity: Rate flow of liquid in a capillary tube - Poiseuille's formula, Determination of coefficient of viscosity of a liquid. Variations of viscosity of a liquid with temperature.

Physics of low pressure - production and measurement of low pressure, Rotary pump, Diffusion pump, Molecular pump, Knudsen absolute gauge, pirani gauge.

Unit-3 Number of lectures = 10 | Title of the unit: Wave Optics

Wave Optics: Electromagnetic nature of light, wave front, Huygens Principle

Interference: Interference by Division of wavefront, Young's Double Slit experiment, Lloyd's Mirror and Fresnel's Bi-prism, Phase change on reflection, Interference by Division of amplitude: Interference in Thin Films: parallel and wedge-shaped films, Fringes of equal inclination and equal thickness, Newton's Rings: measurement of wavelength and refractive index.

Michelson's Interferometer: Idea of shape of fringes (no theory needed), Determination of wavelength, Wavelength difference and refractive index.

0 Title of the unit: Diffraction and Polarization
=1

Diffraction: Fresnel Diffraction, Fraunhofer diffraction: Single slit & Diffraction grating, Resolving and Dispersive Power of grating.

Polarization: Transverse nature of light waves, Plane polarized light - production and analysis, Nicol Prism, Double refraction, Circular and elliptical polarization, Production of circularly and elliptical polarized light, Quarter wave plate and Half wave plate, Specific Rotation.

12. Books Recommended

- 1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill, ISBN Num. 0070323305 9780070323308
- 2. Fundamentals of Optics, H.R., Gulati and D.R., Khanna, R. Chand Publication, 1991, ISBN No. 8180450821
- 3. University Physics, F.W., Sears, M.W., Zemansky and H.D., Young, Addison-Wesley, 1986, ISBN Number 0201603225

13. Online links :

- 1. https://www.youtube.com/watch?v=nOb iQjTy-O&list=PLU14u3cNGP61R5sPDPKVfcFlu95wSs2Kx
- 2. https://nptel.ac.in/courses/122105023/
- 3. https://swayam.gov.in/course/1408-mechanics-heat-oscillations-and-waves
- 4. https://freevideolectures.com/course/2271/physics-i-oscillations-and-waves
- 5. https://nptel.ac.in/courses/122103011/52

Neve mul Door



1.	Name of the Dep	partment: Phy	vsics						
2.	Course Name	Waves and Optics Lab		L	Т		Р		
3.	Course Code	17030402	0 0		0	4			
4. Type of Course (use tick mark)		Core (√)		DSE ()	AEC ()	SEC ()	GE ()		
5.	Pre-requisite (if any)		6. Free (use mar	quency tick ks)	Even (√)	Odd ()	Either Sem ()	Every Sem ()	
7.	Total Number o	f Lectures, Tu	torials, H	Practica	i			1	
Lectures = 0				Tutorials = 0		Practical = 52			

8. Course Description:

In this paper the experiments based on a theoretical concept of light has been introduced such as determination of wavelength by Bi-prism, Newton's ring and gratings.

9. Course Objectives:

To understand the working principles of various instruments such as spectrometer, telescope, laser and their use in determination of physical quantities like wavelength, refractive index and resolving power.

10. Course Outcomes (COs):

After performing these experiment, students will be able to implement and demonstrate the use of

1. Optical instruments like Fresnel's Bi-prism

2. Determination of various physical quantities related to light and materials

3. Study of double slit interference and thin wire by diffraction method (using He-Ne Laser)

4. Study of Telescope and measurement's Specific rotation and concentration using Polarimeter

11. List of Experiments

1. Wave length of Sodium light by Fresnel's Bi-prism.

2. Velocity of ultrasonic waves by grating formation in CC14.

3. Diameter of Lycopodium powder particles by Corona rings.

- 4. To study double slit interference by He-Ne laser.
- 5. Diameter of a thin wire by diffraction method (using He-Ne Laser).
- 6. Young's modulus by Newton's Rings method.
- 7. Resolving power of a prism.
- 8. Thickness of a thin plate using air wedge.
- 9. Resolving Power of plane transmission grating.

10. To determine the wavelength of a monochromatic light using Newton's Rings.

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11. Resolving power of telescope.

12. Measurement of (a) Specific rotation (b)concentration of sugar solution using Polarimeter.

13. Ordinary and extra ordinary refractive indices for calcite or quartz.

12. Book Recommended:

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill, ISBN No. 0070323305 9780070323308

2. Fundamentals of Optics, H.R., Gulati and D.R., Khanna, R. Chand Publication, 1991, ISBN No. 8180450821.

3. University Physics, F.W., Sears, M.W., Zemansky and H.D., Young, Addison-Wesley, 1986, ISBN No. 0201603225

4. Wave and Optics, Dr. D.C. Tayal, Himalaya Publishing House Pvt. Ltd. 2019, ISBN No. 978-93-5299-710-7.

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Zaono per jule :



1. Name of the Depa	artment: Chemistry						
2. Course Name Transition Metal & C		ordination Chemistry	, L	T	P	Р	
2 Comme Code	Electrochemistry & Cl	nemical Kinetics	2				
5. Course Code	1/030403) DCE ()			CEO	
4. Type of Course (I	ise tick mark)	Core (\checkmark)	DSE ()	AEC ()	SEC ()	GE ()	
5. Pre-requisite (if any)	NA	6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()	
7. Total Number of	Lectures, Tutorials, Pr	actical					
Lectures = 40		Tutorials = 0			Practical	= 0	
8. Course Description	on						
This course will give an excellent opportunity to study and use the knowledge of Transition Elements,							
9 Course Objective	s	renemiear Kineties.					
The objectives of this	s course are to:						
1. Study the properties of transition elements.							
2. Understand t	the key features of coord	ination compounds.					
3. Discuss vario	ous concepts of electrocl	hemistry.					
4. Study the rea	action rates, theories of r	eaction rates and diff	erent order i	eactions.			
10. Course Outcome	es (COs)						
Upon successful com	pletion of this course, th	ne student will be able	e to:				
1. Identify the b	behavior of transition ele	ements					
2. Recognize th	e types of isomers and r	iomenclature and app	lications of	coordinati	on compo	unds.	
3. Become fam	the rate of a chemical	plications of electrocr	function of	time			
4. Describe nov	d content	reaction changes as a	runction of	time.			
Unit 1	Jumber of lectures - 00	Title of the unit.	Transition	Flomente	(2d comio	.)	
Concerci create de	tumber of lectures - 05	The of the unit:	Transition	Liements	(Su series	s) 	
General group trends	with special reference t	o electronic configura	ition, variab	le valency	, colour, n	nagnetic	
diagrams) for Mn Fe	and Cu I anthanoids at	ad actinoids. Electron	ic configura	tions ovi	ation stat		
colour, magnetic pro	perties, lanthanide contr	action, separation of l	anthanides	ion excha	nge metho	d only)	
Unit-2 N	umber of lectures = 1() Title of the unit:	Coordinati	on Chemi	strv	u onij).	
Valence Bond Theor	y (VBT): Inner and oute	r orbital complexes o	f Cr. Fe. Co	Ni and C	u (coordin	ation	
numbers 4 and 6). Sti	ructural and stereoisome	erism in complexes w	ith coordina	tion numb	ers 4 and 6	5.	
Drawbacks of VBT.	IUPAC system of nome	nclature. Crystal Field	Theory, oc	tahedral s	ymmetry.	Crystal	
field stabilization ene	ergy (CFSE), Crystal field	ld effects for weak an	d strong fiel	ds. Tetrah	edral sym	metry.	
Factors affecting the	magnitude of Dq. Spect	rochemical series. Co	mparison of	CFSE for	$\cdot O_h$ and T	d	
complexes, Tetragon	al distortion of octahedra	al geometry. Jahn-Te	ller distortio	n, Square	planar		
Unit 3	Jumber of leatures - 11	Title of the unit.	Flootrocho	mistur			
Conductivity equive	lant and malan aandusti	it and their verific	Electroche	mistry 	1 1		
electrolytes Kohlrau	sch law of independent	migration of ions	n with alluti	on for wea	ak and stro	ong	
Transference number	Transference number and its experimental determination using Hittorf and Moving boundary methods.						
onic mobility Application of conductance measurements determination of degree of ionization of weak							
electrolytes, solubilit	y and solubility product	s of sparingly soluble	salts, ionic	product of	water, hy	drolvsis	
constant of a salt. Co	onductometric titrations	(only acid-base).			, ,		
Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst							
equation and its importance. Types of electrodes, Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG , ΔH and ΔS from							
						EMF data.	
Calculation of equilibrium constant from EMF data. Concentration cells with transference and without							
transference. Liquid junction potential and salt bridge.							
Potentiometric titrati	ng nyurogen electrode a	and quilingurone elect	ation reduct	tion only)			
i otentionieu ie turatio	ons- quantative treatmer	n (actu-base and oxid	ation-reduct	non only).		•	
	1						
1	Ata h		1		/		
V.	Ash	AL	10	0	1.		



Unit-	Number of lectures = 10 Title of the unit: Chemical Kinetics
Chen	al Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other
factor	on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for
zero,	st and second order reactions. Half-life of a reaction. General methods for determination of order
ofar	tion. Concept of activation energy and its calculation from Arrhenius equation. Theories of
React	n Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of
the tv	theories (qualitative treatment only).
12. B	f Description of self-learning/ E – learning component
1	https://www.hcpgcollege.edu.in/sites/default/files/TRANSITION%20ELEMENTS%20%28B.SC-
	II%29%20INORGANIC%20CHEMISTRY%20PAPER-I.pdf
2	https://ncerthelp.com/cbse%20notes/class%2012/chemistry/Chemistry%20Notes%20for%20class
	%2012%20Chapter%209%20Coordination%20Compounds%20.pdf
3	https://www.slideshare.net/shahzad_ali27/chemical-kinetics-32001888
4	https://ncerthelp.com/cbse%20notes/class%2012/chemistry/Chemistry%20Notes%20for%20class
	%2012%20Chapter%203%20Electrochemistry%20.pdf
13. B	ks Recommended
1	Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007), ISBN 13: 9780070647749
2	Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004), ISBN-13 : 978-818501559
3	Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd.,
	New Delhi (2009), ISBN-13 : 978-8131508442
4	Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998), ISBN-13: 978-8185015804
5	Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985), ISBN-13 :978-0023947919
6	Cotton, F.A. & Wilkinson, G. Basic Inorganic Chemistry, Wiley, ISBN-13: 978-0471505327
7	Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press, ISBN-13 : 978-
	0198552314
8	Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd, ISBN-13: 978-8176492881
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1. Name of the Departm	nent: Chemistr	y			A state of the sta						
2. Course Name	Transition Me	etal &	Coordination (Chemistry,	L	Τ	P				
	Electrochemis	stry &	Chemical Kine	etics Lab							
3. Course Code	17030404				0	0	4				
4. Type of Course (use	tick mark)	Core	• (√)	DSE ()	AEC ()	SEC ()	GE ()				
5. Pre-requisite	NA	6. Fr	requency	Even (✓)	Odd ()	Either	Every				
(if any)	and the second second	(Use	tick marks)			Sem ()	Sem ()				
7. Total Number of Lectures, Tutorials, Practical											
Lectures = 0 Tutorials = 0 Practical = 52 hrs.											
8. Course Description											
This course provides pra	ctical training in	inorg	anic qualitativ	e analysis, su	urface tension	n and viscos	ity				
measurements and kineti	cs of chemical r	eaction	ns which enabl	le students to	solve the te	chnical prob	lems				
during the separation of	mixtures.										
9. Course Objectives				5			in the start				
The objectives of this co	urse are to:			$\sqrt{1-1}$							
1. Identify differen	t cations and ani	ions in	an inorganic 1	nixture.							
2. Perform experim	ent on surface t	ension	and viscosity								
3. Study the kinetic	s of chemical re	action	s.								
10. Course Outcomes (COs)										
Upon successful complet	tion of this cours	se, the	student will be	e able to:							
1. Separate the con	ponents in an ir	norgan	ic mixture								
2. Identify quality of	of any chemical	and an	y formulation	. Alta Parter							
3. Apply Arrhenius	equation to stud	dy diff	erent chemical	reactions.							
11. List of Experiments	(Student has to	o perfe	orm ten exper	iments – at	least two fro	om each sec	tion)				
Inorganic Chemistry:			•			Contraction of the	NUMERICAN DESCRIPTION				
I. Semi-micro qualitative	analysis (using	H ₂ S o	r other method	ls) of mixtur	es - not more	e than four id	onic				
species (two anions and t	wo cations, exc	luding	insoluble salts	s) out of the	following:						
Cations: NH ₄ ⁺ , Pb ²⁺ , Bi ³	⁺ , Cu ²⁺ , Cd ²⁺ , Fe	e^{3+}, Al^{3}	$^{3+}, \mathrm{Co}^{2+}, \mathrm{Ni}^{2+}, \mathrm{I}$	Mn^{2+}, Zn^{2+}, H	Ba^{2+}, Sr^{2+}, Ca	h^{2+}, K^+					
Anions: CO ₃ ^{2–} , S ^{2–} , SO ₂ [–]	$S_2O_3^{2-}, NO_3^{-}, O_3^{-}, O_3^{$	CH ₃ CC	00 ⁻ , Cl ⁻ , Br ⁻ , I	-, NO ₃ -, SO ₄	²⁻ , PO ₄ ³⁻ , BO	$^{3^{-}}, C_2O_4{^{2^{-}}}, F$	-				
(Spot tests should be can	ried out wherev	er feas	ible)								
II. Estimations											
1. Estimate the amo	ount of nickel pr	esent i	n a given solu	tion as bis(di	imethylglyox	imato) nick	el (II) or				
aluminium as ox	imate in a given	soluti	on gravimetric	ally.							
2. Estimation of (i)	Mg+ or (ii) Zn+	by co	mplexometric	titrations us	ing EDTA.						
3. Estimation of tot	al hardness of a	given	sample of wat	er by comple	exometric tit	ration.					
Physical Chemistry											

I. Electrochemistry

Conductance

- 1. Determination of cell constant
- 2. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- 3. Perform the following conductometric titrations: a. Strong acid vs. strong base
 - b. Weak acid vs. strong base

Potentiometry

- 1. Perform the following potentiometric titrations:
 - a. Strong acid vs. strong base
 - b. Weak acid vs. strong base
 - c. Potassium dichromate vs. Mohr's salt

II. Chemical Kinetics

Study the kinetics of the following reactions by:

1. Initial rate method: Iodide-persulphate reaction



2. Integrated rate method:

- a. Acid hydrolysis of methyl acetate with hydrochloric acid.
- b. Saponification of ethyl acetate with sodium hydroxide.
- c. Compare the strengths of HCl and H₂SO₄ by studying kinetics of hydrolysis of methyl acetate.

12. Brief Description of self-learning/ E - learning component

- 1. https://amrita.olabs.edu.in/?sub=73&brch=7&sim=31&cnt=1
- 2. http://chemlab.truman.edu/files/2015/07/edta.pdf

- 1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012 ISBN 13-978-8131773710
- 2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009, ISBN-13: 978-058222628-9
- 3. Vishwanathan, B.,; Raghavan, P. S. Practical Physical Chemistry, Viva Books, ISBN-13: 978-8130929699.
- 4. Khosla, B. D., Garg, V. C., Gulati, A., Senior Practical Physical Chemistry, R. Chand & Company: 18th edition, ISBN: 978-8180450792.

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1.	Name of the De	partment: Mat	thema	tics						
2.	Course Name	Linear and Abstract Algebra	а 1. 1.	L	J	Γ		Р		
3.	Course Code	17030405		3	()	(0		
4.	Type of Course	(use tick	Core		DSE ()	AEC ()	SEC ()	OE ()		
	mark)			(•)						
5.	Pre-requisite		6. F	requency	Even	Odd ()	Either	Every		
	(if any)		(use tick	()		Sem ()	Sem ()		
7 Total Number of Lectures Tutorials Practical										
Le	ctures = 40	Lectures, ru		Tutorials $= 0$		Practical	= 0			
8.	Course Descrip	tion:					· · · · · · · · · · · · · · · · · · ·			
 basis, Dimension of vector spaces, Quotient spaces etc. It further covers linear transformations, algebra of linear transformations and inner product spaces. 9. Course Objectives: To study certain structures called groups, rings, fields and some related structures. To gain mathematical maturity which enables the students to develop abstract thinking and mathematical skills. To present the basic concepts of vector spaces, linear transformations and inner product spaces. To understand orthogonality and the Gram-Schmidt orthogonalization process. 10. Course Outcomes (COs): After completing this course, students will be able: To understand finite and infinite dimensional vector spaces and subspaces over a field and their properties including the basis structure of vector spaces. To study inner products and understand their related properties. 										
4	To understand l linear transform	basic concepts on nation, algebra o	of linea of trans	ir transformations and	ons, the Ra d the chang	nk-Nullity ge of basis.	theorem,	matrix of		
11.	Unit wise detail	led content								
Un	it – 1 Num	ber of lectures	= 10	Title of the	unit: Grou	ups				
Bir ele Ca Un	ary operation, Cment, Cyclic gryley's theorem, C $it - 2$ Numroduction to ring	Groups, Subgrou oups, Permutat Cosets, Largrage ber of lectures	ips, Fi ions 's theo = 10	nite and Infin groups, Homo prem, Normal s Title of the	ite groups, omorphism subgroups a unit: Ring	order of and ison and Quotie s , Fields ,	a group, O norphism o ent groups. Polynomia	order of a of group		
of a ring Ga	a ring, Homomor gs, Factorization uss lemma, Eiser it - 3	phism and isom of polynomials. Istein criterion for ber of lectures	orphis Polyn or irre = 10	m of rings, Ch omial over the ducibility.	unit: Mat	rices and	rem, Polyn ucibility cri Vector Spa	omial iterion,		
N	v for	of the		foot	c.5	Lette	-			



Elementary transformations, Echelon form, Rank of a matrix, Linear independence and dependence, Solution of systems of linear equations, Eigenvalues and Eigenvectors, Cayley-Hamilton theorem and its applications, Vector spaces: Vector spaces over a field, Subspaces, Spanning Set, Existence of basis, Dimension.

Unit – 4	Number of lectures = 10	Title of the unit: Linear Transformations and	•*
		Inner Product Spaces	

Linear transformations, Null space, Range space of a linear transformation, Matrix of a linear transformation, Change of basis, Rank-nullity theorem, Invariant subspaces, Eigenvalues and Eigenvector of linear transformations, linear functional and dual space, Inner product spaces, adjoint of an operator, normal, unitary and self adjoint operators, Cauchy-Schwarz inequality, Orthogonality, Gram-Schmidt orthogonalization process.

12. Brief Description of self-learning / E-learning component

- 1. https://www.youtube.com/playlist?list=PLEAYkSg4uSQ2PS2t1LNFMHrr1h9Fo2TxT
- 2. https://www.youtube.com/playlist?list=PLyqSpQzTE6M8aLVVwxkJ44abrFFzdioId
- 3. https://www.youtube.com/playlist?list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7

- 1. Joseph A. Gallian: Contemporary Abstract Algebra, (10th edition), CRC Press, 2021..
- 2. P. B. Bhattacharya, S.K. Jain and S.R. Nagpaul: Basic Abstract Algebra (2nd edition), Cambridge University Press, 2003.
- 3. Shanti Narayan and Sat Pal: A Textbook of Modern Abstract Algebra, S. Chand, 1985.
- 4. Seymour Lipschutz and Marc Lipson: Schaum's Outline of Linear Algebra (5th edition), McGraw-Hill, 2012.
- 5. John B. Fraleigh: A First Course in Abstract Algebra (7th edition), Pearson, 2013.
- 6. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence: Linear Algebra (4th edition), Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.

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1. Name of the De	partment: Mat	thematics				
. Course Name	Linear and	L	Τ			P
	Abstract					
	Algebra					
	Lab	0	0			
3. Course Code	1/030406	0			CTC 0	4
4. Type of Course mark)	(use tick	Core (🖋	DSE ()	AEC ()	SEC ()	OE ()
5. Pre-requisite		6. Frequency	Even (Odd ()	Either	Every
(if any)		(use tick			Sem ()	Sem ()
		marks)			Υ.	~
7. Total Number o	f Lectures, Tu	torials, Practical				
Lectures = 0		Tutorials =	: 0	Practical	= 52	
8. Course Descript	tion:	1-				
This course is desig	ned to enhance	e the knowledge	of student	s using th	e algebra	practicals
Emphasis is placed of	on computing d	ifferent results rel	ated to mate	rices and li	inear trans	formation
and inner product sp	baces. Upon co	mpletion, student	s should be	able to w	rite the p	rograms in
MATLAB or other se	oftware.					
9. Course Objectiv	ves:					
Students that succ	essfully comple	ete this course will	be able to:			
1. To compute de	terminant, rank	, inverses of matri	ices			
2. To solve syste	m of linear eq	juations using Ec	helon form	of corres	ponding	coefficien
matrix						
3. To compute eig	envalues, eiger	nvector, rank, null	ity of a line	ar transfor	mation	
4. To compute in	ner products in	\mathbb{R}^n and \mathbb{C}^n .	-			
10. Course Outcom	es (COs):					
After completing the	course, studen	ts are expected to	be able:			1
1. To evaluate dif	fferent properti	es of matrices suc	h as rank. i	nverse, de	terminant	MATLAB
and Mathemati	ca.		, -	,		
2. To solve a syst	em of linear eq	uations.				
3. To compute rai	nk, nullity of lin	near transformatio	n.			
4. To understand	the concept of	inner products.				
11. Unit wise detaile	ed content					

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Using both MATLAB and Mathematica:

- 1. To find the determinants of matrices
- 2. To find the inverse of matrices
- 3. To find echelon form and rank of the matrices
- 4. To find the solution of system of linear equations
- 5. To find the eigenvalues and eigenvectors of the linear transformations
- 6. To find the nullity and rank of linear transformations
- 7. To find the roots of algebraic, Transcendental, Logarithmic equations
- 8. To solve the definite and indefinite integrals
- 9. To compute inner products on \mathbb{R}^n and \mathbb{C}^n .

12. Brief Description of self-learning / E-learning component

- 1. https://in.mathworks.com/learn/tutorials/matlab-onramp.html
- 2. https://www.tutorialspoint.com/matlab/index.htm

- . Amos Gilat: MATLAB: An Introduction with Applications (8th edition), John Wiley & Sons Inc, 2016.
- 2. S. Wolfram: The Mathematica book (5th edition) Cambridge: Cambridge University Press, 2003.

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SEMESTER-V (SEC)



1.	Name of the D	epartment: Phy	sics				1	
2.	Course Name	Computational Physics Skills		L .	Т		Р	
3.	Course Code	17030501	3		0		0	
4.	Type of Course (use tick mark)		Core ()		DSE ()	AEC ()	SEC (√)	GE ()
5.	Pre-requisite (If any)		6.	Frequency (Use tick marks)	Even $()$	Odd ()	Either Sem ()	Every Sem ()
7.	Total Number	of Lectures, Tu	tori	als, Practical				
	Lectures = 40			Tutorials	= 0	Practical	= 0	

8. Course Description:

The aim of this course is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics,

9. Course Objectives:

To impart knowledge about various computer programming method to solve problems in physics.

10. Course Outcomes (COs):

After completion of this course, students will have understanding of:

1. The use of computational methods to solve physical problems

2. Use of computer language as a tool in solving physics problems (applications)

3. Course will consist of hands-on training on the Problem solving on Computers.

11. Unit wise detailed content							
Unit-1	Number of lectures =	Title of the unit: Introduction					

Introduction: Importance of computers in Physics, paradigm for solving physics problems for solution, Introduction to basics of Linux, Windows.

Algorithms and Flowcharts: Introduction: Problem formulation, algorithm development, algorithm implementation, and algorithm verification. Structure and documentation

Flowchart: Concept of flowchart, symbols, guidelines, types.

Unit - 2	Number of lectures =	Title of the unit: Machine representation, precision
	10	and errors

Representation on a computer: Integer representation; floating-point representation; Machine precision; Errors: round-off; approximation errors; random errors; errors of the third kind.

Unit - 3 Number of lectures =		Title of the unit: Roots of equations (flowchart and		
	10	programme, Matlab/Python)		

Real roots of single variable function; iterative approach; qualitative behavior of the function; Closed domain methods (bracketing): Bisection; False position method; Open domain methods: Newton Raphson, Secant method. Flowchart of root finding programme and actual programme (Python/Matlab) to calculate the roots using the above-mentioned methods.

Unit - 4	Number of lectures =	Title of the unit: Data Visualization
	10	

Visualization: Introduction to graphical analysis and its limitations, Introduction to Matplotlib, importance of visualization of computational and computational data, basic Matplotlib

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commands: simple plots, plotting data from a file, saving and exporting, multiple data sets per file, physics with Matplotlib (equations, building functions, user defined variables and functions), Understanding data with Matplotlib

- 1. To write program to generate data and plot it using Matplotlib,
- 2. Saving the output for figure, Saving it as an eps file and as a pdf file.

12. Books Recommended

- 1. Introduction to Numerical Analysis, S,S, Sastry, 5thEdn,, 2012, PHI Learning Pvt, Ltd,
- 2. Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co,
- 3. Computational Physics: An Introduction, R, C, Verma, et al, New Age International Publishers, New Delhi (1999)
- 4. A first course in Numerical Methods, U,M, Ascher and C, Greif, 2012, PHI Learning
- 5. Elementary Numerical Analysis, K,E, Atkinson, 3rdEdn ,, 2007, Wiley India Edition

6. Learning Scientific Programming with Python, Christian Hill, Cambridge University Press, 2016

13. Online Links

<u>https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-010-computational-methods-of-scientific-programming-fall-2011/lecture-notes/</u>
 2.

http://www.physics.ntua.gr/~konstant/ComputationalPhysics/Book/ComputationalPhysicsKNA. html

3. https://www3.nd.edu/~powers/ame.20214/

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1.	Name of the De	epartment: Physi	cs					
2.	Course Name	Applied Optics		L		Т		Р
3.	Course Code	17030502				0		0
4.	Type of Course mark)	e (use tick		Core ()	DSE ()	AEC ()	SEC $()$	GE ()
5.	Pre-requisite (if any)		6.	Frequency (use tick marks)	Even $()$	Odd ()	Either Sem ()	Every Sem ()
7.	Total Number	of Lectures, Tuto	oria	ls, Practical				
	Lectures $= 40$			Tutorials =	0 Pr	actical = 0		

8. Course Description:

The course will teach about different types of light source and detectors, Fourier transform spectroscopy, holography and the phenomenon of interference, diffraction and polarization.

9. Course Objectives:

To impart knowledge about different types of light source and detectors, fourier transform spectroscopy, holography and the phenomenon of interference, diffraction and polarization.

10. Course Outcomes (COs):

Students will have understanding of

1. different types of light sources and detectors

2. how to use Fourier transform spectroscopy for analyzing various physical phenomenon related to light

11. Unit wise detailed content

Unit-1	Number of	Title of the unit: Sources and Detectors	
	lectures = 10		

Sources and Detectors

Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam and He-Ne laser.

Semiconductor Sources and Detectors: Light Emitting Diode, V-I characteristics of LED, Solid State Laser, characteristics of solid state laser, characteristics of LDR, Photovoltaic Cell and Semiconductor lasers.

Unit - 2 Number of		Title of the unit: Fourier Optics			
	lectures = 10				

Fourier Optics

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens, Harmonic analysis of a signal, Amplitude and phase modulations, Transfer function of free space, Optical Fourier transform, Diffraction & Interference, Image shaping, optical image processing.

Fourier Transform Spectroscopy: Fourier Transform Spectroscopy (FTS) and application in atmospheric remote sensing, NMR spectrometry

Unit - 3	Number of lectures	Title of the unit: Holography	
	= 10		• •

Holography

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy, Interferometry, and character recognition in-

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line and off-axis holography; Transmission and reflection holograms, Amplitude and phase holograms, Thick and thin holograms

Unit - 4	Number of lectures	Title of the unit: Photonics: Fibre Optics
	= 10	

Photonics: Fibre Optics

Optical fibres and their properties, Principal of light propagation through a fibre, The numerical aperture, Dispersion, Attenuation in optical fibre and attenuation limit, Absorption loss, scattering loss, bending loss, splice loss. Single mode and multimode fibres, Erbium-doped fiber amplifiers and lasers, Fibre optic sensors: Fibre Bragg Grating

12. Books Recommended

- 1. Fundamental of optics, F, A, Jenkins & H, E, White, 1981, Tata McGraw hill,
- LASERS: Fundamentals & applications, K, Thyagrajan&A,K, Ghatak, 2010, Tata McGraw Hill
- 3. Fibre optics through experiments, M, R, Shenoy, S, K, Khijwania, et, al, 2009, Viva Books
- 4. Nonlinear Optics, Robert W, Boyd, (Chapter-I), 2008, Elsevier,
- 5. Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer,
- 6. Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt, Ltd,
- 7. Optoelectronic Devices and Systems, S,C, Gupta, 2005, PHI Learning Pvt, Ltd,
- 8. Optical Physics, A,Lipson, S,G,Lipson, H,Lipson, 4thEdn,, 1996, Cambridge Univ, Press

13. Online Links

- 1. https://en.wikipedia.org/wiki/Holography
- 2. <u>https://www.youtube.com/watch?v=j4qbhVQQdBQ</u>
- 3. <u>https://www.youtube.com/watch?v=saVE7pMhaxk</u>

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1.	Name of the De	partment: Physics		1			
2.	Course Name	Renewable energy and energy harvesting	L		T .		Р
3.	Course Code	17030503	3				0
4.	Type of Course	(use tick mark)	Core ()	DSE ()		SEC (V)
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (√)	Either Sem ()	Every Sem
7.	Total Number of	of Lectures, Tutoria	als, Practical				1.
Le	ctures = 40		Tutorials = 0		Practical	= 0	
8.	Course Descrip	tion:					

The course will focus on the physical principles underlying energy processes. The application of these principles for harvesting energy from various sources will also be discussed.

9. Course Objectives:

To teach students the fundamental laws and physical processes that governs the sources, extraction, storage, and uses of energy.

10. Course Outcomes (COs):

Students will have enhanced their abilities to:

1. Explain the need to reduce the nonrenewable sources of energy.

2. Explain the importance of natural processes which can act as renewable energy sources.

3. Explain the modern techniques for energy harvesting.

4. Develop critical thinking and solve the problem for energy requirements.

11. Unit wise detailed content

Unit-1	Number of lectures = 8	Title of the unit: Fossil fuels and Alternate	
		Sources of energy	

Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Unit – 2 Number of lectures = 8 Title of the unit: Solar energy

Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

Unit-3 Number of lectures = 13 Other renewable energy harvesting methods

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass. Geothermal

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Energy: Geothermal Resources, Geothermal Technologies. Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Unit-4	Number of lectures = 11	Piezoelectric	and	electromagnetic	energy
		harvesting.			

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power.

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications, Carbon captured technologies, cell, batteries, power consumption, Environmental issues and Renewable sources of energy, sustainability.

12. Brief Description of self learning / E-learning component

- online NPTEL course on Non-Conventional Energy Systems, Prof. L. Umanand, IISc Bangalore, <u>https://nptel.ac.in/courses/108108078/</u>
- 2. https://www.edx.org/course/solar-energy-delftx-et3034x-0
- 3. https://www.edx.org/course/sustainable-energy-design-renewable-delftx-energyx-0
- 4. https://www.edx.org/course/energy-principles-and-renewable-energy-2

- 1. Non-conventional energy sources G, D Rai Khanna Publishers, New Delhi, ISBN: 978-81-7409073-7
- 2. Solar energy M P Agarwal S Chand and Co, Ltd, ISBN: 9788121939713
- Solar energy Suhas P Sukhative Tata McGraw Hill Publishing Company Ltd, ISBN 978-1-56720105-5
- 4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University, ISBN- 9780199261789
- 5. Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009, ISBN: 978-93-87374-12-6,
- J, Balfour, M,Shaw and S, Jarosek, Photovoltaics, Lawrence J Goodrich (USA), ISBN: 0750660732

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3. Course Code 17030504 4. Type of Course (use tick mark) Core () 5. Pre-requisite NA 6. Frequency (use tick marks) 7. Total Number of Lectures, Tutorials, Practical Lectures = 40 Tutorials, Practical Lectures = 40 S. Course Description In the course, students will practice hands-on training in anal experiments of soil, water, food products, and cosmetic analysis. If and instrumental techniques will also be taught. 9. Course Objectives	3 DSE () Even () F lytical chern n the cours analytical nic technique Introduce nature, Ch Chemistry a	0 AEC () Odd (✓) Practical = mistry, for e, practices methods. ues. tion to Ana hemicals ar	0 SEC (✓) Either Sem () 0 example, th of chromato	GE () Every Sem (ne testin graphica
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Introduction to Analytical Chemistry and its interdisciplinary methods, General steps in chemical analysis, Role of Analytical C Wet Ashing). Applications of Chemical Analysis.Unit-2Number of lectures = 08Title of the unit: Title of the unit: Sampling, evaluation of analytical data, errors, accuracy and prece law of distribution and indeterminate errors. A statistical test of confidence intervals.Unit-3Number of lectures = 12Title of the unit:	nature, Cl Chemistry a	nemicals ar	1 1 4	mistry
methods, General steps in chemical analysis, Role of Analytical CWet Ashing). Applications of Chemical Analysis.Unit-2Number of lectures = 08Title of the unit:Sampling, evaluation of analytical data, errors, accuracy and predlaw of distribution and indeterminate errors. A statistical test ofconfidence intervals.Unit-3Number of lectures = 12	Errors in	and Technic	nd Materials	analysi
Wet Ashing). Applications of Chemical Analysis.Unit-2Number of lectures = 08Title of the unit:Sampling, evaluation of analytical data, errors, accuracy and predlaw of distribution and indeterminate errors. A statistical test ofconfidence intervals.Unit-3Number of lectures = 12Title of the unit:	Errors in	ind reening	ques (Evapor	ation an
Unit-2Number of lectures = 08Title of the unit:Sampling, evaluation of analytical data, errors, accuracy and predlaw of distribution and indeterminate errors. A statistical test ofconfidence intervals.Unit-3Number of lectures = 12Title of the unit:	Errore in			
Sampling, evaluation of analytical data, errors, accuracy and pre- law of distribution and indeterminate errors. A statistical test of confidence intervals. Unit-3 Number of lectures = 12 Title of the unit:	LITUISII	Chemical	Analysis	
Iaw of distribution and indeterminate errors. A statistical test of confidence intervals.Unit-3Number of lectures = 12Title of the unit:	cision, met	hods of the	ir expression	ı, norma
Unit-3 Number of lectures = 12 Title of the unit:	data; F, Q	and t-test,	rejection of	data, an
U = 12 $I = 12$ $I = 1111 = 01$ the unit:	C 1 / F			
Classification principle and officiancy of the technique Masher	Solvent E	xtraction	1	1
and chelation. The method of Extraction: batch, continuous and	nism of Ex	traction: Ex	tional Outlit	solvatio
quantitative aspects of solvent extraction: Extraction of metal	ions from		lution Extr	alive an
organic species from the aqueous and non-aqueous media		aqueous se	Jution, LAU	action
Unit-4 Number of lectures = 10 Title of the unit:	Chromat	ogranhy	-	
Classification of chromatographic methods: Principle of diff	ferential m	igration.	Techniques	of pape
chromatography: experimental modifications, various modes of c	developme	nt. nature o	of the paper.	detectio
of spots, retardation factors, factors that affect the reproducibility	of R _f valu	es (due to p	aper, solven	t system
sample, development procedure), selection of solvent, quantitativ	e analysis.	Applicatio	ns	
Thin-layer chromatography: stationary phase, adsorbents, liquid	phase sup	ports, plate	e preparation	ı, mobil
phase, sample application, development, a saturation of chamber	, detection	of spot, R _f	values (effe	ect of th
adsorbent, solvent, solute, development process), quantitative ana	alysis, appl	ications		-
12. Brief Description of self-learning / E-learning component				
1. https://nptel.ac.in/courses/104105084/11				
2. http://www.federica.unina.it/agraria/analytical-chemistry/ana	lytical-che	mistry/		
3. https://www.th-owl.de/fb8/fileadmin/download_verzeichnis/c	chemie/An	alytical_Ch	emistry.pdf	
4. https://nptel.ac.in/courses/102103044/28				
 https://nptel.ac.in/courses/102103044/28 https://nptel.ac.in/courses/102106048/8 				II
 4. https://nptel.ac.in/courses/102103044/28 5. https://nptel.ac.in/courses/102106048/8 13. Books Recommended 				s Colleg
 4. https://nptel.ac.in/courses/102103044/28 5. https://nptel.ac.in/courses/102106048/8 13. Books Recommended 1. Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Anal Publiching Fort Worth (1992) ISPN-0020050290 078002005 	lytical Che	mistry 6th I	Ed., Saunder	1
 4. https://nptel.ac.in/courses/102103044/28 5. https://nptel.ac.in/courses/102106048/8 13. Books Recommended 1. Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Anal Publishing, Fort Worth (1992).ISBN:0030059380 978003005 2. Vogel A. L. Vogel's Qualitative Inorgania Analysia 7th Educational Content of Content o	lytical Che 59384 0030 Prentice Li	mistry 6th I 0168732 97	Ed., Saunder 8003016873	4
 https://nptel.ac.in/courses/102103044/28 https://nptel.ac.in/courses/102106048/8 Books Recommended Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Anal Publishing, Fort Worth (1992).ISBN:0030059380 978003005 Vogel, A. I., Vogel's Qualitative Inorganic Analysis 7th Ed., 13 Robinson, J.W., Undergraduate Instrumental Analysis 7th Ed., 13 	lytical Che 59384 0030 Prentice-H	mistry 6th I 0168732 97 all. ISBN-1	Ed., Saunder 8003016873 10: 58221860	57
 https://nptel.ac.in/courses/102103044/28 https://nptel.ac.in/courses/102106048/8 Books Recommended Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Anal Publishing, Fort Worth (1992).ISBN:0030059380 978003005 Vogel, A. I., Vogel's Qualitative Inorganic Analysis 7th Ed., 1 Robinson, J.W., Undergraduate Instrumental Analysis 7th (1995) ISBN-13 + 978-1420061352 	lytical Che 59384 0030 Prentice-H h Ed., Ma	mistry 6th I 0168732 97 all. ISBN-1 arcel Dekk	Ed., Saunder 8003016873 10: 58221860 er, Inc., No	4 57 w Yor
 https://nptel.ac.in/courses/102103044/28 https://nptel.ac.in/courses/102106048/8 Books Recommended Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Ana Publishing, Fort Worth (1992).ISBN:0030059380 978003005 Vogel, A. I., Vogel's Qualitative Inorganic Analysis 7th Ed., 1 Robinson, J.W., Undergraduate Instrumental Analysis 7th (1995).ISBN-13 : 978-1420061352 Christian, G.D: Analytical Chemistry 6th Ed. John Wile 	lytical Che 59384 0030 Prentice-H h Ed., Ma	mistry 6th I 0168732 97 all. ISBN-1 arcel Dekk	Ed., Saunder (8003016873 10: 58221866 er, Inc., Ne ork 2004 1	4 57 SBN 10
 https://nptel.ac.in/courses/102103044/28 https://nptel.ac.in/courses/102106048/8 Books Recommended Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Ana Publishing, Fort Worth (1992).ISBN:0030059380 978003005 Vogel, A. I., Vogel's Qualitative Inorganic Analysis 7th Ed., 1 Robinson, J.W., Undergraduate Instrumental Analysis 7th (1995).ISBN-13 : 978-1420061352 Christian, G.D; Analytical Chemistry, 6th Ed. John Wile 	lytical Che 59384 003(Prentice-H h Ed., Ma by & Sons	mistry 6th I 0168732 97 Iall. ISBN-1 arcel Dekk s, New Yc	Ed., Saunder 8003016873 10: 58221866 er, Inc., Ne ork, 2004. I	54 57 58 Yor 58 SBN-10
 A. https://nptel.ac.in/courses/102103044/28 5. https://nptel.ac.in/courses/102106048/8 13. Books Recommended 1. Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Ana Publishing, Fort Worth (1992).ISBN:0030059380 978003005 2. Vogel, A. I., Vogel's Qualitative Inorganic Analysis 7th Ed., 1 3. Robinson, J.W., Undergraduate Instrumental Analysis 7th (1995).ISBN-13 : 978-1420061352 4. Christian, G.D; Analytical Chemistry, 6th Ed. John Wile 	lytical Che 59384 0030 Prentice-H h Ed., Ma ≥y & Sons	mistry 6th I 0168732 97 all. ISBN-1 arcel Dekk s, New Yo	Ed., Saunder (8003016873 10: 58221866 er, Inc., Ne ork, 2004. I	4 57 57 SBN-10



0471214728

- Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009. ISBN-10: 1906574006
- 6. Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979. SBN 10: 0853120803 ISBN 13: 9780853120803
- 7. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974. ISBN-10 : 0442221584; ISBN-13 : 978-0442221584

Ato



2. Course Name	Fuel Chemistry	L			Т	P	
3. Course Code	17030505	3			0	0	
4. Type of Course (use	tick mark)	Core ()		DSE ()	AEC ()	SEC (√)	GE ()
5. Pre-requisite	NA	6. Frequen	icy	Even ()	Odd (Either	Every
(if any)		(use tick m	arks)			Sem ()	Sem (
7. Total Number of Lec	tures, Tutorials, 1	Practical					
Lectures = 40		Tutorials =	= 0		Practical	= 0	1
8. Course Description		-				La Constant	
This course includes the s	study of energy sou	arces (renewa	able and no	on-renewal	ble). It also	describes fue	els, coa
gasification and liquefac	ction techniques, H	Petroleum an	d its appli	ications in	industries,	lubricants,	Nuclea
power, and nuclear react	ions.						
9. Course Objectives							
The objectives of this con	urse are to:						
1. Make the students av	vare of renewable	and non-rene	wable ene	rgy source	es.		
2. To build up knowled	ge of the concepts	and science	of fuel che	emistry.		di la	
3. To make them aware	e of the fundament	al physical a	ind chemic	cal princip	les regardir	ng the forma	tion and
A Endow on oworonood	nts in industrial an	d technologic	cal process	ses.			
 Endow all awareness To explain scientific 	and fundamental	and Petroche	inical indu	fuel and m	cations.		
10 Course Outcomes (concepts abou	ut nuclear	ruer and m	uclear react	ions	
At the end of the course	students should be	able to:					
1 Identify and characte	rize various renew	able and non	renewahl	a anarou s	ourcas		
 Develop an understar 	nding of solid liqu	id gaseous a	and nuclear	r fuel	ources.		
 Develop an understan Develop an understan 	nding of the Petroc	chemical Indu	istry annli	cations			
4. Use techniques such	as coal liquefaction	n. solvent ref	fining and	gasificatio	n etc		
11. Unit wise detailed co	ontent	,	ung unu	Busilieutic			
Unit-1	Number of lectu	res = 10 T	itle of the	unit: Fue	ls and Coa	1	5.5
Review of energy source	s (renewable and	non-renewab	le). Classi	fication of	f fuels and	their calorifi	ic value
Uses of coal (fuel and	nonfuel) in variou	is industries,	its comp	osition, ca	rbonization	of coal. C	oal gas
producer gas and water g	as-composition a	and uses. Des	scription o	f Fraction	ation of coa	al tar and the	uses o
coal tar bases and chemic	als requisites for ar	n excellent m	etallurgica	l coke. De	tails of Coa	lgasification	ı (Hydr
gasification and Catalytic	gasification), liqu	efaction, etc.	. Solvent F	Refining.			
Unit-2	Number of lectu	res = 10 Ti	itle of th	e unit: P	etroleum a	and Petroc	hemica
		In	dustries				
Knowledge of the compo	sition of crude Pet	roleum oil, n	nethods us	ed for refi	ning the oil	, types of Pe	troleun
products, and their appl	ications. Fractiona	al Distillation	n (Princip	le and pro	ocess), Crac	cking (Theri	mal and
catalytic cracking), Refor	ming Petroleum a	nd non-petro	leum fuels	s (LPG, Cl	NG, bio-gas	s, fuels deriv	ed from
biomass), fuel from wast	e, synthetic fuels (gaseous and	liquids), c	lean fuels.	Petrochem	icals: Vinyl	acetate
Unit 2	Number of lost	ene and its de	erivatives	Xylene.	•		
An Introduction involving	Number of lectur	es = 10 11	tie of the	unit: Lub	ricants		1
and nonconduction involving	g the classification	of lubricants	, functions	of lubrica	nts, lubrica	ting oils (cor	iductin
index cloud point pour	point) and their de	termination	Machanica	pricants. Pr	operties of	lubricants (v	ISCOSIT
film lubrication Thin filr	n or boundary lubr	ication extre	me pressi	re lubricat	tion	ilouynamic	or Flui
Unit-4	Number of lectur	res = 10 Ti	itle of the	unit. Cas	aous and N	uoloor Fuol	
Introduction to Gaseous t	fuels Natural gas	Producer gas	s Water o	as Analys	tis of Fuel (Gas by using	S Orcat!
apparatus, Nuclear Fuels	nuclear reactions	mass defect	and hindi	as, Allalys	Nuclear Fi	ssion Nucle	, Orsat
reaction. Critical Mass.	Mechanism of nu	clear reaction	ns Nucle	ar Reactor	r and Nuc	lear Fusion	Fusion
reactors. Nuclear fission	vs Nuclear fusion.	Nuclear Safe	etv	ur recueito.	r, and ruc	ical i usioli,	I usio
12. Brief Description of	self-learning/ E-le	earning com	ponent				
1. https://www.svce.ac	c.in/departments/cl	hemistry/CIT	M/CY%2	06251/Eng	og %20Che	m %2011%2	0word/
ly ju	A) in					sword/



- Unit%20V%20-%20Fuels%20&%20Combustion.pdf
- 2. https://nptel.ac.in/courses/112101007/
- 3. https://nptel.ac.in/courses/103105110/

- Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. U.K. (1990). ISBN-10 : 0134573188; ISBN-13: 978-0134573182
- 2. Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi. ISBN-10: 9352160002
- 3. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996). ISBN-10: 8182838290.

(a) APS



1. Maine of the De	epart	ment: Cher	inisti y				
2. Course Name	Ch	emical Tec	hnology & Society		L	Т	P
3. Course Code	17	030506			3	0	0
4. Type of Course	e (use	tick mark)) Core ()	DSE ()	AEC ()	SEC (√)	GE ()
71788992. P I	re-	NA	6. Frequency	Even ()	Odd (✔)	Either	Every
requisite			(use tick marks)		Sem ()	Sem ()
(if any)							
7. Total Number	of Le	ctures, Tut	orials, Practicals				
Lectures = 40		Tut	torials = 0	Practical =	= 0		
8. Course Descrip	otion						
This course will pr	rovide	e an introdu	ction to different princip	les used in che	mical technolo	ogy. It will d	lelineate
the usage of sign	ifican	t processes	and equipment. Studen	ts will be skil	led in how to	evaluate th	ne exact
strategies in the Re	esearc	h and Deve	elopment Laboratories.				
Creating Scientific	litera	acy to under	rstand the complex envir	onmental issue	s prevailing in	the modern	era.
9. Course Objecti	ves						1. 1. 1. 1.
The objectives of t	his co	ourse are to:	:				
1. Introduce stud	ents t	o Major ind	lustrial chemical technol	ogv			
2. Explain the Ind	dustri	al processes	s deployed in chemical e	xtractions.			
3. Familiarize stu	idents	with chem	ical safety				
4. Induce scientif	fic lite	eracy to und	lerstand fermentation and	l polymer chem	nistry.		
10. Course Outco	mes (COs)		F			
Upon successful c	omple	etion of this	course, the student will	be able to:	1		
1. Build a basic kn	owled	dge of the n	rocesses carried out in th	e chemical ind	ustry		
2. Review the prac	tical	importance	and relevance of the pro	cess taking plac	e in the chem	ical industry	,
3. Understand the	techn	ological me	thods to circumvent the	issues in the pro-	ocess plant	ieur meustry	•
4. Study the salien	t feat	ures of the c	chemical processes used	to manufacture	daily needs		
5. Build a bridge h	etwee	en theoretic:	al and practical concepts	used in industr	v		
11 Unit wise deta	iled o	ontent	ai and practical concepts	used in moust	y		
Unit-1	N	mber of le	ctures = 10	Title of th	e unit: Fern	nentation I	ndustry
		under of ie	coures it		te unite i ein	icitation i	
				and Techn	ology of Soan	s and Surfa	ctants
Introduction to fer	menta	tion and tyr	pes of fermentation proc	and Techn	ology of Soap	s and Surfa	entation
Introduction to fermand manufacture of	menta f indu	ation and typ strial alcoh	pes of fermentation proce	and Techn esses. Productio	ology of Soap on of ethyl alco	os and Surfa	entation
Introduction to ferr and manufacture o The manufacturing	menta f indu	ation and typ astrial alcoh	pes of fermentation proce ol, Beers, Wines & Liqu vcerin, by-products from	and Techn esses. Productic ors.	ology of Soap on of ethyl alco cturing Deters	os and Surfa ohol by ferm	entation
Introduction to ferr and manufacture o The manufacturing for the soap indust	f indu g of so ry and	ation and typ Istrial alcoh Dap from gl d their selec	pes of fermentation proce ol, Beers, Wines & Liqu ycerin, by-products from tion.	and Techn esses. Productio ors. n soap; manufa	ology of Soap on of ethyl alco cturing Deterg	os and Surfa ohol by ferm gents, Raw n	entation naterials
Introduction to ferr and manufacture o The manufacturing for the soap indust Unit-2	menta f indu g of so ry and	ation and typ astrial alcoh oap from gl d their selec mber of lec	pes of fermentation proce ol, Beers, Wines & Liqu ycerin, by-products from tion.	and Techn esses. Productio ors. a soap; manufa	ology of Soap on of ethyl alco cturing Deterg	es and Surfa bhol by ferm gents, Raw n	entation naterials
Introduction to ferr and manufacture o The manufacturing for the soap indust Unit-2	menta f indu g of so ry and Nu	ation and typ astrial alcoh oap from gl d their selec mber of lec	pes of fermentation proce ol, Beers, Wines & Liqu ycerin, by-products from tion. tures = 10	and Techn esses. Productio ors. a soap; manufa Title of the Industries	ology of Soap on of ethyl alco cturing Deterg unit: Paper	os and Surfa bhol by ferm gents, Raw n , Pulp and	entation naterials Polyme
Introduction to ferr and manufacture o The manufacturing for the soap indust Unit-2	menta f indu g of so ry and Nu	tion and typ astrial alcoh oap from gl d their selec mber of lec	pes of fermentation proce ol, Beers, Wines & Liqu ycerin, by-products from tion. tures = 10	and Techn esses. Productio ors. a soap; manufat Title of the Industries	ology of Soap on of ethyl alco cturing Deterg unit: Paper,	os and Surfa bhol by ferm gents, Raw n , Pulp and	naterials Polyme
Introduction to ferr and manufacture o The manufacturing for the soap indust Unit-2 Raw materials, pu Polymer and Syn	menta f indu g of so ry and Nu Ilping	tion and typ istrial alcoh oap from gl d their selec mber of lec g processes, Eibar Int	pes of fermentation proce ol, Beers, Wines & Liqu ycerin, by-products from tion. tures = 10 , recovery of chemicals	and Techn esses. Production ors. a soap; manufact Title of the Industries , stock prepara	ology of Soap on of ethyl alco cturing Deterg unit: Paper, ation and pap	os and Surfa bhol by ferm gents, Raw n , Pulp and per. Manufa	naterials Polyme
Introduction to ferr and manufacture o The manufacturing for the soap indust Unit-2 Raw materials, pu Polymer and Sym polyamide acrylic	menta f indu g of so ry and Nu ilping thetic	tion and typ astrial alcoh oap from gl d their selec mber of lec g processes, c Fiber, Int	pes of fermentation proce ol, Beers, Wines & Liqu ycerin, by-products from tion. tures = 10 , recovery of chemicals troduction to polymeriz	and Techn esses. Production ors. in soap; manufact Title of the Industries , stock prepara cation, commo	ology of Soap on of ethyl alco cturing Deterg unit: Paper, ation and pap dity polymers	os and Surfa ohol by ferm gents, Raw n , Pulp and per. Manufa s, rayon, po	retants entation naterials Polyme cture of polyester,
Introduction to ferr and manufacture o The manufacturing for the soap indust Unit-2 Raw materials, pu Polymer and Sym polyamide, acrylic	menta f indu g of so ry and Nui ilping thetic fibre	tion and typ strial alcoh oap from gl d their selec mber of lec g processes, Fiber, Int and nylons	pes of fermentation proce ool, Beers, Wines & Liqu ycerin, by-products from tion. tures = 10 , recovery of chemicals troduction to polymeriz	and Techn esses. Productio ors. a soap; manufa Title of the Industries , stock prepara ration, commo	ology of Soap on of ethyl alco cturing Deterg unit: Paper, ation and pap dity polymers	os and Surfa ohol by ferm gents, Raw n , Pulp and per. Manufa s, rayon, po	retants entation naterials Polyme cture of olyester,
Introduction to ferr and manufacture o The manufacturing for the soap indust Unit-2 Raw materials, pu Polymer and Sym polyamide, acrylic Unit-3	menta f indu g of so ry and Nur alping thetic fibre Nur	ation and typ astrial alcoh oap from gl d their selec mber of lec g processes, c Fiber, Int and nylons mber of lec	pes of fermentation process of, Beers, Wines & Liquy ycerin, by-products from tion. tures = 10 , recovery of chemicals troduction to polymeriz tures = 10	and Techn esses. Productio ors. a soap; manufact Title of the Industries , stock prepara cation, commo	ology of Soap on of ethyl alco cturing Deterg unit: Paper, ation and pap dity polymers e unit: Sulp	es and Surfa book by ferm gents, Raw n , Pulp and ber. Manufa s, rayon, po bhur, Phos	retants entation naterials Polyme cture of olyester, phorous
Introduction to ferr and manufacture o The manufacturing for the soap indust Unit-2 Raw materials, pu Polymer and Sym polyamide, acrylic Unit-3	menta f indu g of so ry and Nui ilping thetic fibre Nui	tion and typ astrial alcoh oap from gl d their selec mber of lec , processes, ; Fiber, Int and nylons mber of lec	pes of fermentation proceed ool, Beers, Wines & Liqu ycerin, by-products from tion. tures = 10 , recovery of chemicals troduction to polymeriz tures = 10	and Techn esses. Productio ors. Title of the Industries , stock prepara ation, commo	ology of Soap on of ethyl alco cturing Deterg unit: Paper, ation and pap dity polymers e unit: Sulp d Chloro-alk	es and Surfa bool by ferm gents, Raw m , Pulp and ber. Manufa s, rayon, po bhur, Phos ali Industri	retants entation naterials Polyme cture of olyester, phorous es
Introduction to ferr and manufacture o The manufacturing for the soap indust Unit-2 Raw materials, pu Polymer and Sym polyamide, acrylic Unit-3 Origin and Extract	menta f indu g of so ry and Nui ilping thetic fibre Nui	tion and typ astrial alcoh oap from gl d their selec mber of lec g processes, c Fiber, Int and nylons mber of lec f sulphur, p	pes of fermentation proceed ol, Beers, Wines & Liqu ycerin, by-products from tion. tures = 10 , recovery of chemicals troduction to polymeriz tures = 10	and Techn esses. Production ors. Title of the Industries , stock prepara tation, commo Title of th Nitrogen an huric acid and	ology of Soap on of ethyl alco cturing Deterg unit: Paper, ation and pap dity polymers e unit: Sulp d Chloro-alk oleum, Extrac	es and Surfa bool by ferm gents, Raw n , Pulp and ber. Manufa s, rayon, po bhur, Phos ali Industri ction of phos	retants entation naterials Polyme cture of olyester, phorous es sphorus,
Introduction to ferr and manufacture o The manufacturing for the soap indust Unit-2 Raw materials, pu Polymer and Sym polyamide, acrylic Unit-3 Origin and Extract and manufacture o	menta f indu g of so ry and Nu alping thetic fibre Nu ion o of pho	tion and typ astrial alcoh oap from gl d their selec mber of lec g processes, e Fiber, Int and nylons mber of lec f sulphur, p	pes of fermentation proce ool, Beers, Wines & Liqu ycerin, by-products from tion. tures = 10 , recovery of chemicals troduction to polymeriz tures = 10 tures = 10	and Techn esses. Production ors. Title of the Industries , stock prepara tation, common Title of th Nitrogen an huric acid and ers. Manufactu	ology of Soap on of ethyl alco cturing Deterg unit: Paper, ation and pap dity polymers e unit: Sulp d Chloro-alk oleum, Extrac ring of ammo	ss and Surfa shol by ferm gents, Raw n , Pulp and ber. Manufa s, rayon, po bhur, Phos ali Industri ction of phos onia, nitric a	retants entation naterials Polyme cture of olyester, phorous es sphorus, cid, and
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- 1. https://nptel.ac.in/courses/103103029/30
- 2. https://www.cleaninginstitute.org/sites/default/files/assets/1/AssetManager/SoapsandDetergentsBook.pdf
- 3. http://www.ictmumbai.edu.in/uploaded files/Polymer Engg and Tech all Sem. Syllabus.pdf
- 4. file:///C:/Users/Dell/Downloads/introduction%20to%20polymer%20science%20(book).pdf
- 5. https://nptel.ac.in/courses/103107086/

6. https://www.elsevier.com/books/biermanns-handbook-of-pulp-and-paper/bajpai/978-0-12-814240-0 7. https://biokamikazi.files.wordpress.com/2013/09/principles_of_fermentation_technology-

stanburry_whittaker.pdf 13. Books Recommended

- 1. Gopala, Rao M., Marshall S., "Dryden's Outlines of Chemical Technology for the 21st Century", Edited by Affiliated East-West Press. ISBN-10: 9788185938790
- Moulijn J. K; Makkee M. and van Diepen A; "Chemical Process Technology", Wiley. ISBN: 978-1-444-32025-1
- Basta, N., "Shreve's Chemical Process Industries Handbook", 5th Ed; McGraw Hill. ISBN-10: 9781259029455
- 4. A joint venture by IISc and IITs, funded by MHRD, Govt of India John W. Hill, Terry W. McCreary & Doris K. Kolb, *Chemistry for changing times* 13th Ed. ISBN-10; 032175087X
- 5. Pulp and Paper Science & Technology Vol. I & II by C.E.Libby. ISBN:NA 1962 edition
- 6. Pulp & Paper Manufacture Vol. I, II, III by Mac Donald. ASIN : B002KLT77Y
- 7. Hand Book of Pulp and Paper Technology by K.W. Britt 2nd edition. ISBN-10; 8123911440
- 8. F.W. Billmeyer, Text Book of Polymer sciencel. ISBN-13: 9788126511105
- 9. M.S. Bhatnagar, Text Book of polymerl. ASIN : B08YKGDRDJ
- C.E. Dryden, —Outlines of Chemical Technologyl, Affiliated East-West Press, 1973. ISBN-10: 9788185938790
- 11. Charles D.Fleddermann, —Engineering Ethicsl, Prentice-Hall, New Mexico, 1999. ISBN-13: 978-0-13-214521-3
- 12. Safety in Process Plant Designl, Wells, G.L. Godwin, London (1980). ISBN: 0711455066 9780711455061 0852951264 9780852951262 0470269073 9780470269077
- 13. Loss Prevention in Process Industriesl, Lees, F.P. Butterworth, Oxford. ISBN: 9780123971890



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3. Course C 4. Type of C	Geometry	L		Т	
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mark)	Course (use tick	Core ()	DSE ()	AEC ()	SEC (🗸)
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7. Total Nu	mber of Lectures,	Futorials, Practical			
Lectures = 40	0	Tutorials =	= 0	P	racticals: A
In mathematic spaces. This c degree and con 9. Course C	cs, solid geometry is course is aimed to p nic, sphere, cones, c	the traditional name for rovide an introduction to ylinders, central conicoids	the geometries the theories and parabo	ry of three- s for gener loids.	dimensional al equation
10. Course C After completi 1. To clas normal	Dutcomes (COs): ng this course, stude ssify the type of con l to the conic.	nts will be able to: ic from its second degree	equation an	nd write equ	nation of tan
 To den To den To und 	nonstrate the knowle lerstand the concepts	properties of a Sphere. dge of cylinders and Cone of Conicoids and Parabol	es. loids.		
11. Unit wise	detailed content			1.1.6	
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eneral equation igin to the poly rector circle o	on of second degree, ints of intersection o of conic, system of co	Tracing of conics, Tanger f a curve and a Line, chor pnic, Confocal conics, pol-	nt at any poi rd of contac ar equation	int to the co t, pole of lin of a conic	nic, Line joine to the cor
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Cones: Equation of a Cone, Intersection of Cone with Plane and a Line, Right circular Cone, enveloping Cone and reciprocal Cone, Equation of a Cylinder, Enveloping and right circular Cylinder.

Unit-4Number of lectures = 8Title of the unit: Central Conicoids and ParaboloidsCentral Conicoids: Equation of tangent plane. Director sphere, Normal to the conicoids, polar plane of a
point, Enveloping cone of a conicoid, enveloping cylinder of a conicoid , Standard equation of a
Paraboloid and its simple properties, Intersection with a Line or a Plane

12. Web links:

- 1. https://www.youtube.com/watch?v=AWXGMeN0Ets
- 2. https://www.youtube.com/watch?v=s1kaJMtZt60

13. Books Recommended

- 1. R. J.T. Bill, Elementary Treatise on Coordinary Geometry of Three Dimentions, Macmillan india Ltd. 1994.
- 2. P.k. Jain and Khalil ahmad: a textbook of Analytical Geometry of Three Dimentions,, Wiley Eastern Ltd. 1999.
- 3. G.B. Thomas and R.L. Finney: calculas, 9th Ed., Pearson Education, Delhi, 2005.
- 4. H. Anton, I. Bivens and S.Davis: Calculas. John Wiley and Sons(Asia) Pvt. Ltd., 2002.
- 5. S. L. Loney: The Elements of Coordinate Geometry, McMillan and Company, London.

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1. Name of th	e Department: Math	iematics				
2. Course	Mathematical	L	T		P	
Name	Modelling)		
3. Course Co	de 17030508	3	0		0	
4. Type of Co	ourse (use tick mark)	Core ()	DSE ()	AEC ()	SEC	OE ()
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7. Total Num	ber of Lectures, Tute	orials, Practical				
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Formulation a optimization, sports, econom modelling. Stu	nd analysis of mather simulation, probability ics, and other areas of dents will participate i	matical models. Mathem , and elementary differ science. To develop ma n formulating models as	natical tools ential equati thematical an well as in ana	include dir ons. Applic d scientific alyzing then	nensional cations to problems n.	analys biolog based
The objective of the course is to introduce mathematical modelling, that is, the construction and analysis of mathematical models inspired by real life problems. The course will present several modelling techniques and the means to analyze the resulting systems.						
10. Course Ou	tcomes (COs):					
 To apply To frame To analyz 11. Unit wise	precise and logical rea quantitative problems the importance of grant gr	soning to design various and model through diffe raph theory in mathemat	problems and rence equation cal modelling	d solve then ons mathema g.	n. atically.	
Unit – 1	Number of lectures :	= 12 Title of the uni	t: Introducti	on to Math	ematical	
	i anisor or roctures	Modelling	minouuen	on to math	ematical	
Basics of Math solving, Conce Sensitivity ana decay model.	ematical Modelling: E pt of mathematical mo lysis, Mathematical M	lementary mathematical delling, System approac odelling through ordinar	models, Role h; formulation y differential	of Mathem n, analysis c equations: 1	atics in p of models Linear gro	roblem
Unit – 2	Number of lectures =	= 12 Title of the unit System of Diffe	: Mathemati rential Equa	cal Modelli tions	ng throu	gh
Mathematical models, Mathe	nodelling through a sy matical modelling of e	stem of ordinary differen pidemics, Stability for a	ntial equation atonomous sy	s of first orc stems, Lyaj	ler: Prey- punov fur	Predato ctions.
Unit – 3	Number of lectures =	= 8 Title of the unit Difference Equa	: Mathemati ations	cal Modelli	ng throu	gh
Mathematical I and genetics, N	Modelling through diff Iathematical modelling	erence equations: Mathe g in probability theory, S	matical mode tability for co	lling in pop ontinuous ar	ulation dy	ynamics e time.
Unit – 4	Number of lectures =	= 8 Title of the unit Partial Differen	: Mathemati tial Equation	cal Modelli ns	ng throu	gh
Mi	Amaliu	Val	c. S. A	alte		



Mathematical modelling through partial differential equations: PDE model for birth-death immigrationemigration process, PDE model for a stochastic epidemic process with no removal, Mathematical modelling through stochastic differential equations, Brownian motion and its properties, Ito formula, Ito integrals and its properties.

12. Brief Description of self-learning / E-learning component

- 1. https://onlinecourses.nptel.ac.in/noc22_ma20/preview
- 2. https://nptel.ac.in/courses/111107113
- 13. Books Recommended

1. J.N. Kapur: Mathematical Modelling (2nd ed.) NEW AGE International Pvt Ltd, 2021.

2. B. Barnes, and G.R. Fulford: G. R., Mathematical Modelling with Case Studies (3rd ed.), CRC Press, 2015.

3. E. A. Bender: An introduction to Mathematical Modeling (1st ed.) Dover Publications, 2012.

4. J.D. Logan and W.R. Wolesensky: Mathematical Methods in Biology, John Wiley & Sons, New York, 2009.

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1. Name of the D	epartment: Mathematic	cs						
2. Course	Discrete Mathematics	L	Т	•		P		
Name								
3. Course Code	17030509	3	0			0		
4. Type of Cours	e (use tick mark)	Core ()	DSE ()	AEC ()	SEC	OE ()		
					(1)			
5 Pro-requisite		6 Fraquanay	Even ()		Fither	Even		
6. Frequency Even () Odd () Either Every								
(If any) (use tick Sem () Sem ()								
7. Total Number	of Lectures, Tutorials,	Practical				<u> </u>		
Lectures $= 40$	or Dectures, rutoriuis,	Tutorials $= 0$	Prac	tical = 0				
8. Course Descrip	otion:		That	iicui U				
 Introduction to discrete structures and their applications like logic, gate and set theory, recursive programming, digital logic and combinatorial circuits, real number representation and finite automata used in computer science. 9. Course Objectives: 1. To provide basic and theoretical competencies those are majorly used in Computer Science. 2. To help students understand and appreciate the basic mathematical knowledge which is fundamental to Computer Science. 3. To understand the counting principles. 4. To discuss some important applications of Boolean algebra and graph theory in real life situations through switching circuits and shortest path algorithms. 10. Course Outcomes (COs): After completing this course, students will be able: 1. To determine the logical equivalence of propositions and the validity of formal arguments via truth tables. 2. To design and construct a combinatorial circuit from a verbal description. 3. To understand Graphs and its applications in study of shortest path algorithms. 								
11. Unit wise detailed content Unit – 1 Number of lectures = 10 Title of the unit: Sets, Counting and Lattices Sets, Relations and their properties, Equivalence relation, Partial order relation, Hasse diagram, Mathematical induction, The basics of counting, Pigeon hole principle and its application, Recurrence relations, Solving recurrence relations, Generating functions, inclusion-exclusion principle								
Unit – 2 Nui	mber of lectures = 8	Title of the unit:	Logics, Lat	tices				
Unit - 2Number of lectures = 8Title of the unit: Logics, LatticesLogic: Statement, Symbolic representation, Proposition, Propositional logic, Compound proposition, Logical operators, Tautologies and Contradiction, Logical equivalence, Validity of arguments, Quantifier, Predicates, Definition of Lattice, Lattices as partially ordered sets and their properties.Unit - 3Number of lectures = 10Title of the unit: Boolean AlgebraBoolean Algebras, De Morgan's laws, Boolean homomorphism, Representation theorem; Boolean polynomials, Boolean Forms and their Equivalence. Minterm Boolean Forms, Sum of products. Canonical forms. Disjunctive normal form and conjunctive normal form, Minimization of Boolean functions, The Karnaugh map method, Switching circuits and applications of switching circuits.								
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Graph, Types of graphs, Matrix representations of graphs, Graph isomorphism, Weighted undirected graphs, Paths, Cycles and circuits, connectivity, Subgraphs, Induced subgraphs, Complete graphs, Bipartite graphs, Euler and Hamilton paths, Travelling salesman problem, Shortest path problem, Dijkstra's algorithm, Euler's theorem on the existence of Eulerian paths and circuits. Trees, Spanning Trees. Minimal spanning Trees and Kruskal's algorithm, Application of trees.

12. Brief Description of self-learning / E-learning component

- 1. https://www.youtube.com/playlist?list=PL0862D1A947252D20
- 2. https://www.youtube.com/playlist?list=PLbMVogVj5nJQ-tIzyygzzLLxomzlbIiE4

13. Books Recommended

- 1. M. K. Venkataraman, N. Sridharan, N. Chandrasekaran: Discrete Mathematics, The National Publishing company, 2003.
- 2. C. L. Liu: Elements of Discrete Mathematics (3rd ed,). Tata McGraw Hill, 2008.
- 3. K. Rosen: Discrete Mathematics and Its Applications (8th ed,), McGraw Hill, 2019.
- 4. Babu Ram: Discrete Mathematics, Pearson Education, 2012.

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1. Name of the De	1. Name of the Department: Physics							
2. Course Name	Solid State Physics	L	T		P			
3. Course Code	17030510	4	0		(0		
4. Type of Course mark)	e (use tick	Core ()	DSE $()$	AEC ()	SEC ()	GE ()		
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (√)	Either Sem ()	Every Sem ()		
7. Total Number	of Lectures, Tu	itorials, Practical	and a start					
Lectures $= 52$		Tutorials = 0	Prac	tical = 0				

8. Course Description:

This course will deepen your understanding of the different types of crystal structures and that will help you to analyze the electrical, mechanical, optical, and magnetic properties of the solids.

9. Course Objectives:

1. To study the basics of crystallography and lattice dynamics.

2. To understand the diamagnetic, paramagnetic and ferromagnetic properties of the materials

3. To understand the dielectric properties of materials.

4. To study basics of band theory and get familiar with superconducting phenomenon.

10. Course Outcomes (COs):

After successful completion of the course, students will

- 1. have a basic knowledge of crystal systems and will be able to calculate thermal and electrical properties in the free-electron model.
- 2. understand the magnetic properties of matter and its applications
- 3. understand the dielectric properties of materials with its applications.
- 4. know the band theory of solids and theory of superconductivity.

11. Unit wise detailed content

Unit-1 Number of lectures = 13 Title of the unit: Crystal Structure

Crystal Structure: Solids: Amorphous and Crystalline Materials, Lattice TranslationVectors, Lattice with a Basis – Central and Non-Central Elements, Unit Cell, Primitive & non-primitive cells Miller Indices, Reciprocal Lattice, Types of Lattices, Brillouin Zones, Diffraction of X-rays by Crystals, Bragg's Law.

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomicand Diatomic Chains, Acoustical and Optical Phonons, Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, T³ law

Unit - 2 Number of lectures = 13 Title of the unit: Magnetic Properties of Matter

Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials, Classical Langevin Theory of dia – and Paramagnetic Domains, Quantum Mechanical Treatment of Paramagnetism, Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains, Discussion of B-H Curve, Hysteresis and Energy Loss.

Unit - 3 Number of lectures = 13 Title of the unit: Dielectric Properties of Materials

Dielectric Properties of Materials: Polarization, Local Electric Field at an Atom, Depolarization Field, Electric Susceptibility, Polarizability, Clausius Mosotti Equation,

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Classical Theory of Electric Polarizability, Normal and Anomalous Dispersion.

Unit - 4	Number of lectures = 13	Title of the unit: Elementary band theory and	
		superconductivity	

Elementary band theory: Kronig Penny model, Band Gaps, Conductors, Semiconductors and insulators, P and N type Semiconductors, Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient,

Superconductivity: Experimental Results, Critical Temperature, Critical magnetic field, Meissner effect, Type I and type II Superconductors, London's Equation and Penetration Depth, Isotope effect.

12. Books Recommended

- 1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt, Ltd, ISBN : 978-8126535187
- 2. Elements of Solid State Physics, J,P, Srivastava, 2nd Ed,, 2006, Prentice-Hall of India, ISBN : 978-8120350663
- 3. Introduction to Solids, Leonid V, Azaroff, 2004, Tata Mc-Graw Hill, ISBN: 978-0882753454
- 4. Solid State Physics, Neil W, Ashcroft and N, David Mermin, 1976, Cengage Learning, ISBN : 978-9387067721
- 5. Solid State Physics, Rita John, 2014, McGraw Hill, ISBN : 978-9332901797
- 6. Elementary Solid State Physics, 1/e M, Ali Omar, 1999, Pearson India, ISBN : 978-0201607338

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7. Solid State Physics, M, A, Wahab, 2011, Narosa Publications, ISBN : 978-8184874938

13.Online links

1. https://www.youtube.com/watch?v=qh29mj6uXoM

2. <u>https://www.youtube.com/watch?v=2pCdQ2gkwjQ</u>

3. https://www.youtube.com/watch?v=nBW4max0fuU

4. https://nptel.ac.in/courses/115101012/

5.https://nptel.ac.in/courses/122101001/20



1.	1. Name of the Department: Physics							
2.	Course Name	Solid State	L			Т		P
		Physics Lab						State 1
3.	Course Code	17030511	0		1	0		4
4.	Type of Course mark)	(use tick	Core ()	$\begin{array}{ c } \mathbf{DSF} \\ (\sqrt{)} \end{array}$	C	AEC ()	SEC ()	GE ()
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even	n ()	Odd (√)	Either Sem ()	Every Sem ()
7.	7. Total Number of Lectures, Tutorials, Practical							
	Lectures = 0		Tutorials = ()]	Practical =	= 52	

8. Course Description:

Experiments include the fundamental of materials used in making solar cell, semiconductor diodes, laser diode etc.

9. Course Objectives:

To understand the working of solar cell, semiconductor diode laser diode etc. and application of their characteristics in making solid state devices.

10. Course Outcomes (COs):

After performing the experiment, the student will be able to convert solar energy into electrical energy using solar cell, laser diode and design circuits rectifier, amplifier etc.

11. List of Experiments

- 1. Verification of inverse square law by photo-cell.
- 2. To study the characteristics of a solar cell.
- 3. To draw forward and reversed bias characteristics of a semiconductor diode.
- 4. Zener Diode voltage regulation characteristics.
- 5. E.C.E. of hydrogen using Ammeter.
- 6. Low resistance by Carey Foster's Bridge with calibration.
- 7. Frequency of A.C. mains and capacity by electrical vibrator.
- 8. Frequency of A.C. mains by sonometer using an electromagnet.
- 9. Measurement of angle dip by earth Inductor.

10.To study Hall effect.

12. Book Recommended:

- 1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House, ISBN : 978-0423738902.
- 2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers, ISBN : 978-0435686666.
- 3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Ed., 2011, KitabMahal, New Delhi, ISBN : 978-8122504163.
- 4. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India, ISBN: 978-8120350663.

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1.	Name of the De	epartment: Physic	es				
2.	Course Name	Atomic, Molecular and Laser Physics	L		T		Р
3.	Course Code	17030512	4		0		0
4.	Type of Course	e (use tick mark)	Core ()	DSE (√)	AEC ()	SEC ()	GE ()
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (√)	Either Sem ()	Every Sem ()
7.	Total Number	of Lectures, Tuto	rials, Practical			L	
	Lectures = 52		Tutorials =	0 I	Practical =	= 0	
8.	Course Descrip	otion:	-				

Atom and molecule are the fundamental unit for all matters in universe. Matter, whatever the states, is made of atoms. The properties of all matters are governed by the electronic structure of atom and molecule. They have individual properties like electronic, magnetic and optical properties, which are quite different from the collective properties of matter made of atoms and molecules. This course will enlighten the knowledge of atoms and molecules and build up the pre-requisite knowledge for all science and engineering field.

9. Course Objectives:

- 1. Comparison between atomic emission spectroscopy and atomic absorption spectroscopy; Optical spectroscopy, Atomic spectrum.
- 2. Molecular spectroscopy.
- 3. Theory of magnetic energy, Anomalous Zeeman's effect and Landue splitting.factor.
- 4. Working principle of different types of laser and its applications.

10. Course Outcomes (COs):

After successful completion of the course, students will be able to

- 1. Describe theories explaining the structure of atoms and the origin of the observed spectra.
- 2. Explain the observed dependence of atomic spectral lines on externally applied electric and magnetic fields
- 3. Understand the basics of Laser.
- 4. Explain different Laser used and make a comparison between them.

11. Unit wise detailed content

The of the unit. Rome spectroscopy	Unit-1	Number of lectures = 13	Title of the unit: Atomic spectroscopy
------------------------------------	--------	-------------------------	----------------------------------------

Basic concept of atom model and need of vector atom model, Vector atom model, Quantum numbers associated with vector atom model, Penetrating & non- penetrating orbits, Alkali spectra (Description), Spectral lines in different series of alkali spectra, Spin orbit interaction and doublet

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term separation, LS coupling and jj coupling description, Expression for interaction energy in LS coupling, Expression for interaction energy in jj coupling.

Unit - 2 Number of lectures = 13 Title of the unit: Molecular Spectroscopy

Normal Zeeman effect, Anomalous Zeeman Effect, Zeeman pattern of D_1 and D_2 lines of Na atom, Paschen Back effect of a single valance electron system, Weak field Stark effect of H-atom, Discrete set of electronic energies of molecules, Quantization of vibrational energies, Quantization of rotational energies, Raman effect (Quantitative Description), Stokes and Anti-stokes lines. Fundamentals of ESR and NMR.

Unit - 3	Number of lectures = 13	Title of the unit: Basics of lasers
Unit - 3	Number of lectures = 13	Title of the unit: Basics of lasers

Main features of Laser (Directionality and Intensity, Monochromaticity and Coherence), Spontaneous and stimulated emission, Einstein coefficients and population inversion, Laser pumping. Modes of resonators and coherence length.

Unit - 4	Number of lectures = 13	Title of the unit: Working of lasers
----------	-------------------------	--------------------------------------

RUBY Laser (Principle, construction & working), He-Ne Laser (Principle, construction & working), Nd-YAG Laser, CO₂ Laser (Principle, construction & working), Semiconductor Laser (Principle, construction & working), Application of Laser in the field of medicine and industry.

12. Books Recommended

- 1. Jain, V,K, Introduction to Atomic and Molecular Spectroscopy, New Delhi: Narosa, ISBN : 978-8173197758
- 2. White, H E, Introduction to Atomic Spectra, ISBN: 978-9352604777
- 3. Herzberg, G, Molecular Spectra and Molecular Structure, ISBN : 978-0486601151
- 4. Banwell, Fundamentals of Molecular Spectroscopy, ISBN: 978-9352601738
- 5. Thyagrajan and Ajay Ghatak, Lasers, Theory and Applications, 2nd ed, ISBN : 978-1461426943
- 6. Laud, B,B, Laser and Nonlinear Optics, 2nd ed, ISBN: 978-8122430561

13. Online links

- 1. https://nptel.ac.in/courses/104104085/
- 2. https://nptel.ac.in/courses/115105100/56

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1.	. Name of the Department: Physics							
2.	Course Name	Atomi Laser	c, Molecular and Physics Lab	L		Т		Р
3.	Course Code	17030	513	0		0		4
4.	Type of (Course	(use tick mark)	Core ()	DSE()	AEC ()	SEC ()	GE ()
5.	Pre-requ (if any)	isite		6. Frequency (use tick marks)	Even ()	$\begin{array}{c} \text{Odd} \\ () \end{array}$	Either Sem ()	Every Sem()
7.	Total Nu	mber o	f Lectures, Tutor	rials, Practical			I	-

Lectures = 0	Tutorials = 0	Practical = 52

8. Course Description:

Experiments based on atomic and molecular physics and related topics such as determination of e/m ratio by Thomson method, basic characteristics of G.M counter etc.

9. Course Objectives:

To learn by performing experiment based on G.M. Counter, cathode ray oscilloscope, spectrometer etc.

10. Course Outcomes (COs):

After performing these experiment students will be able to demonstrate the experiment and their practical applications.

11. List of Experiments

- 1. To measure thickness of wire using He-Ne Laser.
- 2. To measure the wavelength of Laser Light using Diffraction method.
- 3. To measure the wavelength of Laser Light using Michealson interferomenter.
- 4. e/m by Thomson method.
- 5. Transistor as voltage Amplifier in C-B configuration.
- 6. Transistor as voltage Amplifier in C-E configuration.
- 7. Study of B-H Curve by C.R.O.
- 8. Study of Hartley Oscillator (Calibration of Gang Condenser).
- 9. Measurement of Energy Gap of Four Probe Method.

10. Rydberg constant by Hydrogen gas spectrum.

12. Book Recommended:

- 1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House, ISBN : 978-0423738902.
- 2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers, ISBN : 978-0435686666.
- 3. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Ed., 2011, KitabMahal, New Delhi, ISBN : 978-8122504163.
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India, ISBN: 978-8120350663.

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1. Name of the Department: Physics											
2.	Course Name	Biophysics and Radiation Science	L		Т		Р				
3.	Course Code	17030514	4		0		0				
4.	Type of Course mark)	e (use tick	Core ()	DSE $()$	AEC ()	SEC ()	GE ()				
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even (√)	Odd ()	Either Sem ()	Every Sem ()				
7.	Fotal Number of Lectures, Tutorials, Practical										
	Lectures = 52		Tutorials	Tutorials = 0		Practical = 0					
8.	Course Descrip	otion:									

The biophysics course provides an introduction to the rapidly growing inter-disciplinary subject at the interface of physics and biology. It employs physics concepts and explores their applicability in biology. This course assists students in developing a system-level understanding of biology and provides students with the necessary mathematical and scientific skills.

9. Course Objectives:

The aim of this course is to develop problem-solving ability across a wide range of biologicallypertinent physical, chemical and mathematical domains. Have a foundation in evolutionary biology, cell biology, and other biological science areas

10. Course Outcomes (COs):

After completing this course, students will be able to understand and explain the basic concepts of:

1. Atomic & molecular structure

2. Thermodynamic & Bioenergetic in biological systems

3. Physio-chemical Foundations

4. Basics of Nuclear Physics

11. Unit wise detailed content

Unit-1 Number of lectures = 13 Title of the unit: Atomic & Molecular structure

Structure of atom, Various Models & theories, Periodic table, Concept of bonding; Types of bonding valence of carbon; hybridizations of carbon; molecular orbital theories, polar & nonpolar molecules; inductive effect; Secondary bonding: weak interactions, hydrogen bonding; dipole-dipole & dipole-induced dipole interactions; covalent, Hydrogen, Electrostatic, Van der Waals forces Bond lengths & Bond energies, Bond angles, Concept of isomerism.

Unit - 2 Number of lectures = 13 | Title of the unit: Physio-chemical Foundations

Acid & Bases, mole concept, Molarity & Normality, weak acids, Ampholyte, pH, Calculations of pH, numerical problems. Redox potential: Oxidation-Reduction, Equivalence of electrical & chemical energy, Electrochemical cell, contact potentials, galvanic cell, the potential of half-cell, redox potentials & its calculations by Nernst equation, standard electrode potentials & its determination, its relationship with emf, Types of electrodes.

Unit - 3Number of lectures = 13Title of the unit: Physical Foundations of BiophysicsThermodynamicsofBiological system: First and second laws of thermodynamics,

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Activation energy. Biological systems as open, non-equilibrium systems, Concept of free energy, unavailable energy, entropy, the heat content of food, bomb calorimetry, Enthalpy, Negative entropy as applied to biological systems. thermodynamics of Passive and active transport, biological clocks.

Unit - 4 Number of lectures = 13 Title of the Unit: Basics of Nuclear Physics and Effects of Radiation

Nucleus, constituents of the nucleus, Properties of Nucleus size, mass, density, energy, charge, binding energy, nuclear angular momentum, nuclear force, Nuclear Transformations: Radioactivity, decay constant, activity half-life, mean life, radioactive series, radioactive equilibrium, modes of decay: α -decay, β -decay, Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell

12. Books Recommended

- 1. Rodney Cotterill; Biophysics: An Introduction, John Wiley & Sons.
- 2. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
- 3. Modern Physics, John R, Taylor, Chris D, Zafiratos, Michael A, Dubson, 2009, PHI Learning

4. Chemical Bonds: An Introduction to Atomic and Molecular Structure, Harry B. Gray, University Science Books, 1994.

- 5. Principles of Modern Chemistry by David W. Oxtoby, 2002, S.Chand (G/L) & Company.
- 6. Introduction To Biophysics by Pranab Kumar, S Chand & Company 2010

13. Online Links

1. https://nptel.ac.in/courses/115101121

2. https://nptel.ac.in/courses/115102017/2

3.<u>https://www.youtube.com/watch?v=iMhDYarsfII&rel=1&color1=0xcbba9f&color2=0xcbba9f</u> &border=0&fs=1

4. https://nptel.ac.in/courses/115101010/downloads/lec1.pdf

5. https://nptel.ac.in/courses/115104043

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1.	1. Name of the Department: Physics												
2.	Course	Biophysics and	L	Т		Р							
	Ivame	Science Lab											
3.	Course Code	17030515	0	0		4							
4.	Type of Course (use tick mark)		Core ()	DSE $()$	AEC 0	SEC ()	GE 0						
5.	Pre-requisite (If any)		6. Frequency (Use tick marks)	Even ()	$\begin{array}{c} \text{Odd} \\ (\sqrt{)} \end{array}$	Either Sem ()	Ever y Sem ()						
7.	7. Total Number of Lectures, Tutorials, Practical												
	Lectures = 0		Tutorials =	0 Practical = 52									
8.	8. Course Description:												

The experiments are designed to assistance students in their biophysics laboratory class. It helps them to understand laboratory operations and essential information about physical and chemical phenomena that support many biological processes.

9. Course Objectives:

This course aims to facilitate the acquisition of knowledge of physical phenomena fundamental for biological processes and the understanding of the principles and modern methods in biophysics.

10. Course Outcomes (COs):

After successful completion of the course, students will be able to verify

- 1. The theoretical and practical understanding of biophysics by performing experiment
- 2. Demonstrate the practical application of biophysics etc. in actual practice

11. List of Experiments

- 1. Determination of the frequency of an electrically maintained tuning fork by Melde's experiment.
- Determination of the coefficient of Viscosity of water by capillary flow method (Poiseuille's method).
- 3. Verification of Beer Lamberts Law.
- 4. Simulating Cellular Automata Matlab/Python
- 5. Finding Equilibrium Points in Lotka Volterra System using Python/Matlab.
- 6. Simulate Random Walks with Python/Matlab.
- 7. To draw the Plateau of G.M. Counter
- 8. To determine the Mass attenuation coefficient by G.M. Counter.
- 9. Study some simple tests of proteins.
- 10. Study the variation of cell potential of Zn | Zn2+ | | Cu2+ | Cu cell with change in the concentration of electrolytes (CuSO4 and ZnSO4) at room temperature.
- 12. Recommended Books and Virtual Labs

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- 1. <u>https://math.libretexts.org/Bookshelves/Scientific_Computing_Simulations_and_Modelin_g/</u>
- 2. http://amrita.olabs.edu.in/?sub=73&brch=8&sim=153&cnt=1
- 3. http://amrita.olabs.edu.in/?sub=73&brch=8&sim=140&cnt=1
- 4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- 5. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Ed., 2011, KitabMahal, New Delhi
- 6. Elements of Solid-State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
- 7. College Practical Chemistry, By V K Ahluwalia, Sunita Dhingra, Sunita Dhingra, University Press, 2005

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1. Name of the Department: Chemistry							
2. Course Name	Analytical N	Analytical Methods in Chemistry L			Т	Р	
3. Course Code	17030516	17030516 4			4	0	. 0
4. Type of Course (use tick)	nark) Core ()		D	DSE (\checkmark) AEC ()		SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	E	ven ()	Odd (✔)	Either	Every
(if any)		(use tick marks)		1.2		Sem ()	Sem ()
7. Total Number of Lecture	s, Tutorials, 1	Practicals			- All and the		
Lectures = 52 Tutorials = Nil Practical					Practical =]	Nil	
8. Course Description	and the second						

This course provides an excellent opportunity to learn about Sampling, evaluation of analytical data, analyzing and identifying samples using different spectroscopic techniques like Infra-red, UV, Visible, flame absorption spectrometry. This course also emphasizes on applications of thermogravimetry, electrochemistry and separation methods like chromatography.

9. Course Objectives

The objectives of this course are to:

- 1. Learn the basic principles of different instrumentation.
- 2. Introduce Origin of spectra, fundamental laws of spectroscopy and selection rules.
- 3. Theory of thermogravimetry (TG) and its application.
- 4. Understand the mechanism and efficiency of separation techniques like solvent extraction, chromatography.
- 5. Introduce electro analytical methods to study different types of titrations.

6. Learn the basic principle of flame photometry and techniques of atomization and sample introduction.

10. Course Outcomes (COs)

Upon successful completion of this course, the student will be able to:

- 1. Identify choice of source, monochromator and detector for single and double beam instrument in spectrometry.
- 2. Apply and verify Lambert Beer's Law.
- 3. Use Flame photometers for the quantitative estimation of trace level of metal ions from water samples
- 4. Explain mechanism of extraction: extraction by solvation and chelation. Technique of extraction:
- 5. Calculate Enantiomeric excess (ee)/ diastereomeric excess (de) ratios and determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents.
- 6. Understand the advantage of determining the equivalence point by performing conductometric and potentiometric titrations over volumetric titration.

7. Determine pKa values using pH meter.

11. Unit wise detailed content

Unit-1	Number of lectures = 08	Title of the unit: Qualitative and Quantitative aspects of
		analysis

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Unit-2 Number of lectures = 20 Title of the unit: Optical methods of analysis

UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

Basic principles of quantitative analysis: Estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques. Structural illustration through interpretation of data, Effect and importance of isotope substitution.

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.



Unit 3	Number of lectures - 10 Titl	o of the units Thermal matheds of makering a
Unit-5	Number of fectures = 10 Title	e of the unit: Thermal methods of analysis and
Theory of therr	mogravimetry (TG) basic principle of	finstrumentation. Techniques for quantitative estimation
of Ca and Mad	from their mixture. Classification of	about a production of the standard and the
of Ca and Mg	and approximation titrations. Tash	electro analytical methods, basic principle of pH metric,
Tachniques	and conductometric intrations. Tech	inques used for the determination of equivalence points.
I echinques use	Number of leatures $= 14$ Title	of the unit. Commention Technique
Columnt outro	Number of lectures – 14 11th	e of the unit: Separation Techniques
solvent extrac	coluction and chalation. Tachnique	efficiency of the technique. Mechanism of extraction:
extraction by	solvation and cheration. Technique	of extraction: batch, continuous and counter current
extractions. Qu	analize and quantitative aspects of s	olvent extraction: extraction of metal ions from aqueous
solution, extrac	stion of organic species from the aque	eous and nonaqueous media.
Chromatograp	pny: Classification, principle and e	fficiency of the technique, Mechanism of separation:
adsorption, par	tition & ion exchange. Developmen	it of chromatograms: frontal, elution and displacement
methods. Quali	tative and quantitative aspects of chro	omatographic methods of analysis: IC,
GLC, GPC, II	LC and HPLC. Stereoisomeric sepa	aration and analysis: Measurement of optical rotation,
calculation of E	Enantiomeric excess	
12. Brief Desci	ription of self-learning/ E – learning	g component
1. http://www	.oswego.edu/~kadima/CHE425/chap	ter1_all_one%20slide%20per%20handout.pdf
2. http://web.i	iitd.ac.in/~sdeep/Electronic.pdf	
3. https://npte	l.ac.in/courses/103108100/module5/n	nodule5.pdf
4. https://npte	l.ac.in/courses/103108100/module4/r	nodule4.pdf
13. Books Reco	ommended	
1. Jeffery, G.I Analysis, Jo	H., Bassett, J., Mendham, J. & Denne ohn Wiley & Sons, 1989.ISBN-10: 9	y, R.C. Vogel's Textbook of Quantitative Chemical 780582446939
2. Willard, H.	H., Merritt, L.L., Dean, J. & Settoe, I	F.A. Instrumental Methods of Analysis, 7th Ed.
Wadsworth	Publishing Company Ltd., Belmont,	California, USA, 1988. ISBN-10: 0534081428
3. Christian, C 047121472	G.D; Analytical Chemistry, 6th Ed. Jo 8	ohn Wiley & Sons, New York, 2004. ISBN-10:
4. Harris, D. (C. Exploring Chemical Analysis, Ed.	New York, W.H. Freeman, 2001.ISBN-10:
5 Khankar S	U. M. Davis Concents of Analytical Ch	
5. Knopkar, S 10:1906574	4006	emistry. New Age, International Publisher, 2009.ISBN-
6. Skoog, D.A Ed. ISSN: 2	A. Holler F.J. & Nieman, T.A. Princip 2279–0543	les of Instrumental Analysis, Cengage Learning India
7. Mikes, O. I Analytical	Laboratory Hand Book of Chromatog Chemistry, John Wiley & Sons, 1979	raphic & Allied Methods, Elles Harwood Series on .ISBN-10: 0853120803
8. Ditts, R.V.	Analytical Chemistry; Methods of Se	eparation, van Nostrand, 1974. ISBN-10:0442221584
8. Ditts, R.V.	Analytical Chemistry; Methods of Se	eparation, van Nostrand, 1974. ISBN-10;0442221584

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	Analytical Met	hods in Chemistry Lab	L	Т		Р
3. Course Code	17030517		0	0		4
4. Type of Course (use	tick mark)	Core ()	DSE (√)	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even ()	$Odd(\checkmark)$	Either	Every
(if any)		(use tick marks)			Sem ()	Sem (
7. Total Number of Le	ctures, Tutorials	s, Practicals				
Lectures = 0		Tutorials = 0	P	ractical = 5	2 hrs.	
8. Course Description						
Practical work has had	a central and disti	inct role in chemistry edu	ucation (from	n school to	university) for mo
han a century. The ain	n of chemistry is	to increase our underst	tanding of t	he composi	tion, prop	erties an
change of matter. Claim	s and explanation	ns in chemistry should b	e supported	by observat	tional data	l .
The module designed l	nere for students	is to understand the ba	asic princip	les and lean	rn the exp	periment
echniques of classical t	itrimetric and gra	vimetric methods of ana	lysis. The st	udent will a	lso be intr	oduced
common instrumental t	echniques includ	ing chromatography, sp	ectrophoton	netry, ion e	xchange i	resins an
electro-analytical metho	ds.					
. Course Objectives						i policie.
The objectives of this co	ourse are to:					and the second
1. Understand the b	asic principles ar	nd learn the experimenta	l techniques	of classical	titrimetri	c metho
of analysis,						
2. Understand the th	neory behind the	instrumental techniques	of chromato	graphy, spe	ctrophoto	metry, i
exchange and ele	ectro-analytical m	nethods				
3. Perform experim	ents with sample	s of water to determine l	BOD and CO	OD and diss	solved oxy	gen.
4. Determine the ac	idity and alkalini	ity in soil samples.				
5. Study and apply	the principle of c	omplexometry for detec	ting metals i	in samples a	at the ppm	level.
6. Use flame photo	metry method for	r detecting alkali metals	in sample as	s they give	characteris	stic cold
in flame.			-			
10. Course Outcomes (COs)		1			
	tion of this cours					
Jpon successful comple	cuon or uns cours	se, the student will be ab	le to:			
Jpon successful complete. Refer to the chemication of the chemication	al theory behind t	se, the student will be ab the use of modern instru	le to: mental techr	niques for q	uantitative	chemic
Jpon successful comple Refer to the chemics analysis.	al theory behind t	se, the student will be ab the use of modern instru	le to: mental techr	niques for q	uantitative	chemic
 Dpon successful complete Refer to the chemicanalysis. Identify and estimate 	al theory behind t e traces of metals	se, the student will be ab the use of modern instru- s using the theory of con	le to: mental techr nplexation w	niques for quith EDTA	uantitative	chemic
 Dpon successful complete Refer to the chemication analysis. Identify and estimate Analyze soil for its 	al theory behind t e traces of metals pH and total solu	se, the student will be ab the use of modern instru- s using the theory of con ble salt content.	le to: mental techr nplexation w	niques for q	uantitative	chemic
 Dpon successful complete Refer to the chemical analysis. Identify and estimat Analyze soil for its Determine Na, Ca a 	al theory behind t e traces of metals pH and total solu nd Li In fruit juic	se, the student will be ab the use of modern instru- s using the theory of con ble salt content. ses and cola drinks by ap	le to: mental techr nplexation w pplying flam	niques for quivith EDTA	uantitative ric technic	chemic jue.
 Jpon successful complete Refer to the chemica analysis. Identify and estimat Analyze soil for its Determine Na, Ca a Use chromatograph 	al theory behind t e traces of metals pH and total solu nd Li In fruit juic y to separate mi	se, the student will be ab the use of modern instru- s using the theory of con ble salt content. ses and cola drinks by ap xtures of metal ions, dy	le to: mental techr nplexation w oplying flam yes, sugars,	niques for q vith EDTA e photometr amino acid	uantitative ric technic s and var	e chemic jue. ious oth
 Jpon successful completent Refer to the chemicanalysis. Identify and estimat Analyze soil for its Determine Na, Ca a Use chromatograph samples and calcula 	al theory behind t e traces of metals pH and total solu nd Li In fruit juic y to separate mi te their Rf values	se, the student will be ab the use of modern instru- s using the theory of con ble salt content. thes and cola drinks by ap xtures of metal ions, dy s.	le to: mental techr nplexation w oplying flam res, sugars,	hiques for q vith EDTA e photometi amino acid	uantitative ric technic s and var	e chemic jue. ious oth
 Dpon successful completion Refer to the chemical analysis. Identify and estimat Analyze soil for its Determine Na, Ca a Use chromatograph samples and calcula List of Experiment 	al theory behind t e traces of metals pH and total solu nd Li In fruit juic y to separate mi te their Rf values s (Student has to	se, the student will be ab the use of modern instru- s using the theory of con- ble salt content. the sand cola drinks by ap extures of metal ions, dy be perform ten experime	le to: mental techr nplexation w oplying flam res, sugars, ents – at lea	niques for quith EDTA e photometri amino acid st two from	uantitative ric technic s and vari	e chemic jue. ious oth ction)
 Jpon successful completion Refer to the chemical analysis. Identify and estimate Analyze soil for its Determine Na, Ca a Use chromatograph samples and calcula List of Experiment Chromatography 	al theory behind t e traces of metals pH and total solu nd Li In fruit juic y to separate min te their Rf values s (Student has to	se, the student will be ab the use of modern instrum s using the theory of con ble salt content. ses and cola drinks by ap xtures of metal ions, dy b perform ten experime	le to: mental techr nplexation w oplying flam yes, sugars, ents – at lea	niques for quith EDTA e photometri amino acid st two fron	uantitative ric technic s and vari n each see	e chemic jue. ious oth ction)
 Jpon successful complete Refer to the chemical analysis. Identify and estimate Analyze soil for its Determine Na, Ca a Use chromatograph samples and calcula List of Experiment Chromatography Paper chromatograph 	al theory behind t e traces of metals pH and total solu nd Li In fruit juic y to separate mine te their Rf values s (Student has to thic separation of	se, the student will be ab the use of modern instruc- s using the theory of con- ble salt content. The sand cola drinks by ap xtures of metal ions, dy perform ten experime Fe^{3+} , Al^{3+} , and Cr^{3+} .	le to: mental techr nplexation w oplying flam res, sugars, ents – at lea	niques for q with EDTA e photometr amino acid st two from	uantitative ric technic s and vari n each sec	chemic que. ious oth ction)
 Jpon successful completer in the chemical analysis. Identify and estimate in the chemical analysis. Identify and estimate in the chemical analysis. Identify and estimate in the chemical analysis. Determine Na, Ca a second construction of the chemical second construction of the chemical second construction. Use chromatography is a second construction of the chemical second construction. Chromatography is a second construction of the chemical second construction. Separation and identification. 	al theory behind t e traces of metals pH and total solu nd Li In fruit juic y to separate mine te their Rf values s (Student has to thic separation of the i fication of the i	se, the student will be ab the use of modern instru- s using the theory of con- ble salt content. tes and cola drinks by ap xtures of metal ions, dy b perform ten experime $(Fe^{3+}, Al^{3+}, and Cr^{3+}, monosaccharides present)$	le to: mental techr nplexation w oplying flam yes, sugars, ents – at lea t in the give	niques for quith EDTA e photometri amino acid st two from n mixture (uantitative ric technic s and vari n each se glucose &	e chemic jue. ious oth ction)
 Jpon successful complete Refer to the chemical analysis. Identify and estimate Analyze soil for its Determine Na, Ca a Use chromatograph samples and calcula List of Experiment Chromatography Paper chromatograph Separation and iden by paper chromatograph 	al theory behind t e traces of metals pH and total solu nd Li In fruit juic y to separate mine te their Rf values s (Student has to thic separation of tification of the reaphy. Reporting	se, the student will be ab the use of modern instru- s using the theory of con- ble salt content. the ses and cola drinks by ap xtures of metal ions, dy perform ten experime Fe^{3+} , Al ³⁺ , and Cr ³⁺ . monosaccharides present the R _f values.	le to: mental techr nplexation w pplying flam res, sugars, ents – at lea t in the give	niques for quith EDTA e photometri amino acid st two from n mixture (uantitative ric technic s and vari n each see glucose &	chemic ious oth ction)
 Dpon successful completion Refer to the chemical analysis. Identify and estimat Analyze soil for its Determine Na, Ca a Use chromatograph samples and calcula List of Experiment Chromatography Paper chromatograph Separation and iden by paper chromatograph Separate a mixture of the samples and samples 	al theory behind t e traces of metals pH and total solu nd Li In fruit juic y to separate min te their Rf values s (Student has to hic separation of tification of the r raphy. Reporting of Sudan yellow a	se, the student will be ab the use of modern instru- s using the theory of con- ble salt content. the sand cola drinks by ap xtures of metal ions, dy perform ten experime res^{3+} , Al ³⁺ , and Cr ³⁺ . monosaccharides present the R _f values. and Sudan Red by TLC to	le to: mental techr nplexation w oplying flam res, sugars, ents – at lea t in the give technique ar	hiques for quivith EDTA e photometri amino acid st two from n mixture (nd identify t	uantitative ric technic s and vari n each see glucose & hem on th	chemic que. ious oth ction) fructos
 Dpon successful completentiation Refer to the chemical analysis. Identify and estimatentiation Analyze soil for its Determine Na, Ca a Use chromatograph samples and calcula List of Experiment Chromatography Paper chromatograph Separation and identiation by paper chromatograph Separate a mixture of their R_f values. 	al theory behind t e traces of metals pH and total solu nd Li In fruit juic y to separate min te their Rf values s (Student has to hic separation of tification of the r raphy. Reporting of Sudan yellow a	se, the student will be ab the use of modern instrum s using the theory of com- ble salt content. ses and cola drinks by ap xtures of metal ions, dy perform ten experime res^{3+} , Al ³⁺ , and Cr ³⁺ . monosaccharides present the R _f values. and Sudan Red by TLC to	le to: mental techr nplexation w oplying flam yes, sugars, ents – at lea t in the give technique ar	hiques for quivith EDTA e photometri amino acid st two from n mixture (nd identify t	uantitative ric technic s and vari n each see glucose & hem on th	e chemic jue. ious oth ction) fructos he basis
 Dpon successful completentiation Refer to the chemical analysis. Identify and estimatentiation Analyze soil for its Determine Na, Ca a Use chromatograph samples and calcula List of Experiment Chromatography Separation and identiation by paper chromatographics Separate a mixture of their R_f values. Chromatographic separation se	al theory behind t e traces of metals pH and total solu nd Li In fruit juic y to separate mine te their Rf values s (Student has to thic separation of tification of the metal of Sudan yellow a	se, the student will be ab the use of modern instruc- s using the theory of con- ble salt content. Sees and cola drinks by ap xtures of metal ions, dy b perform ten experime $(Fe^{3+}, Al^{3+}, and Cr^{3+})$. monosaccharides present the R _f values. and Sudan Red by TLC to ctive ingredients of plant	le to: mental techr nplexation w oplying flam res, sugars, ents – at lea t in the give technique ar ts, flowers a	hiques for quivith EDTA e photometri amino acid st two from n mixture (nd identify t	uantitative ric technic s and vari n each see glucose & hem on th 7 TLC	e chemic jue. ious oth ction) fructos ae basis



II. Solvent Extractions:

- 1. To separate a mixture of Ni²⁺ & Fe²⁺ by complexation with DMG and extracting the Ni²⁺-DMG complex in chloroform, and determine its concentration by spectrophotometry.
- 2. Solvent extraction of zirconium with amberlite LA-1, separation from a mixture of irons and gallium.
- 3. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.
- 4. Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.
- 5. Analysis of soil:

Ion exchange:

- I. Determination of exchange capacity of cation exchange resins and anion exchange resins.
- II. Separation of metal ions from their binary mixture.
- III. Separation of amino acids from organic acids by ion exchange chromatography.

III. Spectrophotometry:

- 1. Determination of pKa values of indicator using spectrophotometry.
- 2. Structural characterization of compounds by infrared spectroscopy.
- 3. Determination of dissolved oxygen, (COD) and (BOD) in water.
- 4. Determine the composition of the ferric-salicylate/ ferric-thiocyanate complex by Job's method.

12. Brief Description of self-learning/E - learning component

- 1. http://www.egyankosh.ac.in/bitstream/123456789/15886/1/Experiment-5.pdf
- 2. http://www.cee.ntu.edu.sg/aboutus/CEELabs/Env/Documents/LabManu/CV2701%202A-6.pdf
- 3. https://pubs.acs.org/doi/abs/10.1021/ed007p724

- 1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.ISBN-10: 9780582446939
- 2. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.ISBN-10: 0534081428
- Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004. ISBN-10: 0471214728
- 4. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.ISBN-10: 0716705710.
- 5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009.ISBN-10:1906574006
- Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed. ISSN: 2279–0543
- 7. Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.ISBN-10 : 0853120803
- 8. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974. ISBN-10;0442221584



1. Name of the Departm	nent: Chemistry			-		
2. Course Name	Molecules of Life	L	1		I	•
3. Course Code	17030518	4	0		()
4. Type of Course (use	tick mark)	Core ()	DSE (✔)	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even ()	Odd (✔)	Either	Every
(if any)		(use tick marks)			Sem ()	Sem ()
7. Total Number of Leo	ctures, Tutorials, Pra	ctical				
Lectures = 52		Tutorials = 0	Pra	ctical = 0		
8. Course Description					N. Contraction	
The complexity of ever	the simplest life for	ms, the single cell,	cannot be	overstated.	From a c	hemical
perspective, cellular con	nponents can be segre	egated into macrom	olecules (D	NA, RNA,	proteins e	etc.) and
relatively simpler mole	cules (amino acids,	monosaccharaides	and lipids).	This cour	rse highlig	ghts the
classification, synthesis,	structure and propert	ties of these molecu	les of life.	This course	also inclu	udes the
chemistry of these biomo	olecules and their roles	s in metabolism.				
9. Course Objectives						(
The objectives of this co	urse are:					
1. To study the classific	cation and general pro	operties of carbohyd	rates, protein	ns, amino a	cids, enzy	mes and
lipids.						
2. To determine the pri	mary structure and syn	nthesis of peptides				
4. To understand the m	NA corrige constinuir	nes.				
5 To understand the in	terrelationships in the	metabolic pathways	of Protains	Eats and C	anhahridua	taa
10 Course Outcomes (metabolic pathways	of Proteins,	Fais and C	arbonydra	tes.
Linon successful complet	tion of this course the	student will be able	to:			
1 Identify the different	biomolecules and elu	siduent will be able	10:			
 Recificity of Explain Specificity of Explain Specificit	f enzyme action Enzy	when inhibitors and t	eir importa	200		
3 Differentiate betwee	n oil and fats: calculat	e saponification valu	le and iodine	number		
4. Get detailed knowled	dge about Nucleic acid	is and DNA		e number.		
5. Describe the Outline	of catabolic pathways	of Carbohydrate- G	vcolvsis Fe	rmentation	Krebs cvo	le and
other biomolecules.	or calle one paining s	or curbony didte o	, y cory 515, r c	intentation,	, Iticos cyt	ic, and
11. Unit wise detailed c	ontent					
Unit-1 Numbe	er of lectures = 20	Title of the unit: (Carbohvdra	tes and Pro	oteins	
Classification of carboh	ydrates, reducing an	d non-reducing sug	ars, Genera	l propertie	s of gluc	ose and
fructose, their open chain	n structure. Epimers, 1	mutarotation and an	omers. Deter	rmination o	f configur	ation of
Glucose (Fischer proof)	. Cyclic structure of	glucose. Haworth	projections.	Cyclic stru	cture of f	ructose.
Linkage between mor	nosaccharaides, struc	ture of disacchar	ides (sucro	se, maltos	se, lactos	e) and
polysaccharides (starch a	and cellulose) excludin	ng their structure elu	cidation.			
Classification of Amino	Acids, Zwitterion stru	cture and Isoelectric	point. Over	view of Pri	imary, Sec	ondary,
Tertiary and Quaternary	structure of proteins. I	Determination of pri	mary structu	ire of peptic	les, detern	nination
of N-terminal amino acid	d (by DNFB and Edma	an method) and C-te	erminal amir	o acid (by	thiohydan	toin and
with carboxypeptidase	enzyme). Synthesis	of simple peptid	es (upto d	lipeptides)	by N-pr	otection
(tbutyloxycarbonyl and p	ohthaloyl) & C-activat	ing groups and Merr	ifield solid p	phase synth	esis.	
Unit-2 Number o	f lectures = 12 Ti	itle of the unit: Enz	ymes and c	orrelation	with drug	action
Mechanism of enzyme a	ction, factors affecting	g enzyme action, Co	penzymes ar	nd cofactors	s and their	role in
1.1.1.1.1.0			(retion tion to a	Enzyme in	1 .1 .	
biological reactions, Spe	cificity of enzyme act	ion (including stered	ospecificity)	, Enzyme n	inibitors a	nd their
biological reactions, Spe importance, phenomenor	cificity of enzyme act n of inhibition(Comp	ion (including stered etitive and Non- co	ompetitive in	hibition in	cluding a	nd their llosteric
biological reactions, Spe importance, phenomenor inhibition). Drug action-	cificity of enzyme act n of inhibition(Comp receptor theory. Struct	ion (including stered etitive and Non- co ture –activity relatio	ompetitive in nships of dru	hibition in ug molecule	cluding a es, binding	nd their llosteric g role of
biological reactions, Spe importance, phenomenon inhibition). Drug action-1 -OH group,-NH ₂ group,	cificity of enzyme act n of inhibition(Comp receptor theory. Struct double bond and arom	ion (including stered etitive and Non- co ture –activity relatio natic ring,	ompetitive in nships of dru	hibition in ug molecule	cluding a cluding a cluding a	nd their llosteric grole of
biological reactions, Spe importance, phenomenon inhibition). Drug action- -OH group,-NH ₂ group, Unit-3 Number o	cificity of enzyme act n of inhibition(Comp receptor theory. Struct double bond and arom flectures = 10 Ti	ion (including stered etitive and Non- co ture –activity relatio natic ring, itle of the unit: Nuc	by the providence of the provi	nd Lipids	cluding a allocations and a cluding allocation allocati	nd their llosteric g role of
biological reactions, Spe importance, phenomenor inhibition). Drug action- -OH group,-NH ₂ group, Unit-3 Number o Components of nucleic a	cificity of enzyme act n of inhibition(Comp receptor theory. Struct double bond and arom f lectures = 10 Ti cids: Adenine, guanine	ion (including stered etitive and Non- co ture –activity relatio natic ring, itle of the unit: Nuc e, thymine and cytos	by the providence of the provi	nd Lipids re only), oth	nitibitors a cluding a es, binding	nd their llosteric g role of nents of
biological reactions, Spe importance, phenomenor inhibition). Drug action-1 –OH group,-NH ₂ group, Unit-3 Number o Components of nucleic a nucleic acids, Nucleoside (Watson Crick model)	cificity of enzyme act n of inhibition(Comp receptor theory. Struct double bond and arom f lectures = 10 T cids: Adenine, guaning es and nucleotides (no	ion (including stered etitive and Non- co ture –activity relatio natic ring, itle of the unit: Nuc e, thymine and cytos menclature), Struct	bompetitive in nships of dru leic Acids a ine (Structur ure of polyn	nd Lipids re only), oth	hibitors a cluding a es, binding her compo Structure	nd their llosteric g role of nents of of DNA
biological reactions, Spe importance, phenomenor inhibition). Drug action- -OH group,-NH ₂ group, Unit-3 Number o Components of nucleic a nucleic acids, Nucleoside (Watson-Crick model) a Replication Transcription	cificity of enzyme act n of inhibition(Comp receptor theory. Struct double bond and arom <u>f lectures = 10 Ti</u> cids: Adenine, guaning es and nucleotides (no and RNA (types of I n and Translation Little	ion (including stered etitive and Non- co ture –activity relation natic ring, itle of the unit: Nuc e, thymine and cytos menclature), Struct RNA), Genetic Coc	by the second se	nd Lipids re only), othucleotides; al roles of	hibitors a cluding a es, binding her compo Structure DNA and	nd their llosteric g role of nents of of DNA d RNA:
biological reactions, Spe importance, phenomenor inhibition). Drug action- -OH group,-NH ₂ group, Unit-3 Number o Components of nucleic a nucleic acids, Nucleoside (Watson-Crick model) a Replication, Transcriptio	cificity of enzyme act n of inhibition(Comp receptor theory. Struct double bond and arom f lectures = 10 Ti cids: Adenine, guaning es and nucleotides (no and RNA (types of I n and Translation. Intr	ion (including stered etitive and Non- co ture –activity relatio natic ring, itle of the unit: Nuc e, thymine and cytos menclature), Struct RNA), Genetic Coc roduction to lipids, c	bompetitive in nships of dru leic Acids a ine (Structur ure of polyn le, Biologica lassification	nd Lipids nd Lipids re only), oth ucleotides; al roles of Oils and fa	hibitors a cluding a es, binding her compo Structure DNA and ats: Comm	nd their llosteric g role of nents of of DNA 1 RNA: on fatty
biological reactions, Spe importance, phenomenor inhibition). Drug action- -OH group,-NH ₂ group, Unit-3 Number o Components of nucleic a nucleic acids, Nucleoside (Watson-Crick model) a Replication, Transcriptio	cificity of enzyme act n of inhibition(Comp receptor theory. Struct double bond and arom f lectures = 10 T i cids: Adenine, guanine es and nucleotides (no and RNA (types of I n and Translation. Intr	ion (including stered etitive and Non- co ture –activity relation natic ring, itle of the unit: Nuc e, thymine and cytos menclature), Struct RNA), Genetic Coc roduction to lipids, c	by the second se	nd Lipids re only), othucleotides; al roles of Oils and fa	hibitors a cluding a es, binding ner compo Structure DNA and ats: Comm	nd their llosteric g role of nents of of DNA d RNA: on fatty
biological reactions, Spe importance, phenomenor inhibition). Drug action- -OH group,-NH ₂ group, Unit-3 Number o Components of nucleic a nucleic acids, Nucleoside (Watson-Crick model) a Replication, Transcriptio	cificity of enzyme act n of inhibition(Comp receptor theory. Struct double bond and arom f lectures = 10 Ti cids: Adenine, guaning es and nucleotides (no and RNA (types of I n and Translation. Intr	ion (including stered etitive and Non- co ture –activity relation natic ring, itle of the unit: Nuc e, thymine and cytos menclature), Struct RNA), Genetic Coc roduction to lipids, c	by the second se	nd Lipids re only), othucleotides; al roles of Oils and fa	hibitors a cluding a es, binding her compo Structure DNA and ats: Comm	nd their llosteric grole of nents of of DNA d RNA: on fatty



acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

Unit-4 Number of lectures = 10 Title of the unit: Concept of Energy in Biosystems

Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate-Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates.

12. Brief Description of self-learning/E - learning component

1.https://www.chem.purdue.edu/courses/chm333/

2.https://ocw.mit.edu/high-school/biology/exam-prep/molecular-genetics/rna-dna-structure-function/

- 1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). ISBN-9788131704813
- 2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).ISBN-13 : 978-8177585421
- 3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education) ISBN-13: 978-8177585414
- 4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman ISBN-13: 978-1464126116
- 5. Berg, J.M., Tymoczko, J.L. & Stryer, L. Biochemistry, W.H. Freeman, 2002, ISBN-13: 978-0716746843



2. Course Name	Molecules of Li	fe Lab	L]	[]	2
3. Course Code	17030519		0	()	4	1
4. Type of Course (use	tick mark)	Core	e ()	DSE (√)	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Fr	equency	Even ()	Odd (Either	Every
(if any)		(use tick marks) Sem ()				Sem ()	Sem
7. Total Number of Lec	tures, Tutorials,	Practical	S				
Lectures = 0		Tute	orials = 0	Pra	ctical = 52	hrs.	
8. Course Description							
Practical work has had a	central and distin	ct role in c	chemistry edu	cation (from	school to un	niversity)	for mor
than a century. The aim	of chemistry is t	to increase	e our understa	anding of the	e compositi	on, proper	rties an
change of matter. Claims	and explanations	s in chemis	stry should be	supported b	y observatio	onal data.	
This course provides pra	ctical training to t	the student	ts to use vario	us methods t	o estimate,	separate,	detect of
analyze samples containi	ng biomolecules.	Different	techniques like	e chromatog	raphy, extra	ction meth	nod, aci
base titrations, organic sy	ynthesis are introc	luced.					
7. Course Objectives							
ne objectives of this co	urse are to:						
. independently carry	out organic synthe	esis					
2. Enable students to	prepare their ow	n solution	ns for experi	ment having	; complete	knowledg	ge abou
normality, molality,	molarity, mole fra	action, as i	neasures of co	oncentration.			
5. Plan and carry out ac	d-base titrations;	; justify ch	oice of indica	tor and inter	pret titration	n curve	
. To differentiate the r	educing and non-	reducing s	ugars.				
U. Course Outcomes (COS)	.1 1					5
pon successful complet	tion of this course	, the stude	ent will be able	e to:			
Prepare biochemical	reagents for var	ious solut	ions with res	pect to diffe	erent Norma	ality, Mol	arity, 9
Solutions (W/V) , (V/V)	v) & numericals.						
2. Perform titrations wit	th suitable indicate	ors to dete	ct sharp end p	oint and quar	ntitatively e	stimate the	desire
samples.			<u> </u>				
Dremons all presented	c methods to sepa	rate mixtu	res of amino a	acids.			
+. Prepare chromatog	rams, separate p	igments f	rom extracts	of leaves a	nd flowers/	ink mixtu	ires an
Determine indine value	e. We and cononifice	tion value	of fot/oil				
1 List of Experiments	ue and saponifica	tion value	of fat/oil.				
1. List of Experiments			1				1.1.1.1
. Separation of amino	acids by paper ch	romatogra	pny				
Study of titration our	icentration of give	sine solution	on by formyla	tion method.			
A stion of culturation cur	ve of glycine						
F. Action of salivary an	iylase on starch			1			
To determine the second	e on the action of a	salivary ai	nylase on star	ch.			
To determine the sap	initiation value	of an $011/1$	at.				
Differentiate Later	ine value of an of	1/fat					
5. Differentiate between	h a reducing and r	non-reduci	ng sugar.				
Extraction of DNA fi	rom onion/caulific	ower					
0. To synthesize aspirit	n by acetylation of	of salicylic	e acid and coi	mpare it with	h the ingred	dient of ar	i aspiri
2 Priof Deceription of	colf looming/ F	le e un tre e					
2. DITEL DESCRIPTION OF	sen-learning/ E.	- learning	g component			x.	
http://eprayoglekha.	n/bitstraam/12244	6780/159	.pui 07/1/Even	ont 12 - 16			
http://egyankosn.ac.n	nscanada ge ca/an	nnarchive	/100/205/201	/io/odo/soion	a /analich/k	io/moint	alaanat
cs.html	iseanaua.ge.ea/ep	pparentve	100/203/301/	ic/cuc/scient	e/english/t	no/project	s/genei
3. Books Recommende	d						-
or books recommende							
	(a)	A	3 h	-			



- 1. Furniss, B.S.; Hannaford, A.J.; Rogers, V.; Smith, P.W.G.; Tatchell, A.R. Vogel's Textbook of Practical Organic Chemistry, ISBN No-9788177589573
- 2. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry, Universities Press.ISBN-13: 978-8173714757

tor



2 Course Name	tment: Cnemistry					
a. Course Manne	Quantum Chemistry,	Spectroscopy &	L	Т		Р
	Photochemistry					
3. Course Code	17030520		4	0		0
4. Type of Course (us	e tick mark)	Core ()	DSE (√)	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even ()	Odd (Either	Every
(if any)	(use tick marks) Sem ()				Sem ()	Sem ()
7. Total Number of L	ectures, Tutorials, Pr	acticals	and the second		and the second second	2.1
Lectures = 52		Tutorials =	0 P	ractical = 0		
8. Course Description	1					
This course provides a	thorough knowledge c	of the methods of Qu	antum mech	nanics and th	ne different	types
of spectroscopic techni	iques like Vibrational,	Rotational, Electror	nic, Raman a	nd Nuclear I	Magnetic	
Resonance (NMR) spe	ctroscopies for underst	anding the molecula	ar structure a	ind nature of	f chemical	
bonding. It also highlig	ghts the basic laws of p	hotochemistry, ener	rgy levels, qu	antum yield	and exam	ples of
photochemical reaction	ns.					
9. Course Objectives		· · · · · · · · · · · · · · · · · · ·				
The objectives of this of	course are to:					
1. Introduce the conc	ept of need of quantum	mechanics on failu	re of classic	al mechanic	s.	
2. Aware the student	about postulates of qua	antum mechanics an	d apply then	n to derive e	quations fo	or
various models inc	luding hydrogen atom	too.				
3. Study of various ty	pes of spectra and thei	r use in structure elu	ucidation.			
4. Study the principle	s and laws of photoche	emistry and apply th	em in field o	of chemistry	biology,	
biochemistry, bion	nedicine etc.					
10. Course Outcomes	(COs)					a la serie de la s
Upon successful comp	letion of this course, th	e student will be ab	le to:			
1. Understand and b	asic principles of quant	tum mechanics				
2. Define chemical b	oonding and able to und	derstand its various	theories			
3. Gain importance	of vibrational, Raman,	Electronic, NMR ar	nd ESR spect	troscopic tec	hniques in	• •
structure determin	nation.					
4. Apply the laws of	photochemistry, Lamb	pert-Beer's law, def	ine terms like	e photosensi	tization,	
quenching, chemi	luminescence etc.					
11. Unit wise detailed	content					
Init_1 N	-			a faith and the second		
	umber of lectures = 13	8 Title of the u	unit: Quant	um Chemis	try	
Postulates of quantum	$\frac{\text{umber of lectures} = 18}{\text{mechanics, quantum}}$	8 Title of the understand	unit: Quant rs, Schroding	um Chemis ger equation	t ry and its	1
Postulates of quantum application to free part	umber of lectures = 13 mechanics, quantum icle and "particle-in-a-	B Title of the mechanical operator box" (rigorous treat	unit: Quant rs, Schroding ment), quant	um Chemis er equation ization of er	try and its hergy level	5, zero-
Postulates of quantum application to free part point energy and Heise	umber of lectures = 1 mechanics, quantum icle and "particle-in-a- mberg Uncertainty prin	8 Title of the understand the second	unit: Quant rs, Schroding ment), quant ns, probabili	um Chemis ger equation ization of er ty distribution	try and its hergy level on function	5, zero- s,
Postulates of quantum application to free part point energy and Heise nodal properties, Exten	umber of lectures = 1 mechanics, quantum icle and "particle-in-a- onberg Uncertainty prin ision to two and three c	8 Title of the u mechanical operator box" (rigorous treat iciple; wave function limensional boxes, s	unit: Quant rs, Schroding ment), quant ns, probabili separation of	um Chemis ger equation ization of er ty distributio variables, d	try and its hergy level on function egeneracy.	s, zero- s,
Postulates of quantum application to free part point energy and Heise nodal properties, Exten Qualitative treatment of	umber of lectures = 1 mechanics, quantum icle and "particle-in-a- mberg Uncertainty prin ision to two and three c of simple harmonic osc	8 Title of the u mechanical operator box" (rigorous treat iciple; wave function limensional boxes, s illator model of vib	unit: Quant rs, Schroding ment), quant ns, probabili separation of rational mot	um Chemis er equation ization of er ty distributio variables, d ion: Setting	try and its hergy level on function egeneracy up of Schro	s, zero- s, ödinger
Postulates of quantum application to free part point energy and Heise nodal properties, Exten Qualitative treatment of equation and discussion	amber of lectures = 13 mechanics, quantum icle and "particle-in-a- mberg Uncertainty prin ision to two and three of of simple harmonic osc n of solution and wave	8 Title of the u mechanical operator box" (rigorous treat iciple; wave function limensional boxes, s illator model of vib functions. Vibration	unit: Quant rs, Schroding ment), quant ns, probabili separation of rational mot nal energy o	um Chemis ger equation ization of er ty distributio `variables, d ion: Setting f diatomic m	try and its nergy levels on function egeneracy up of Schro olecules an	s, zero- s, ödinger nd zero-
Postulates of quantum application to free part point energy and Heise nodal properties, Exten Qualitative treatment of equation and discussion point energy.	amber of lectures = 13 mechanics, quantum mice and "particle-in-a- inberg Uncertainty print ision to two and three of of simple harmonic osc in of solution and wave	8 Title of the u mechanical operator box" (rigorous treat iciple; wave function limensional boxes, s illator model of vib functions. Vibration	unit: Quant rs, Schroding ment), quant ns, probabili separation of rational mot nal energy of	um Chemis er equation ization of er ty distributio variables, d ion: Setting f diatomic m	try and its nergy levels on function egeneracy up of Schro olecules an	s, zero- s, ödinger nd zero-
Postulates of quantum application to free part point energy and Heise nodal properties, Exten Qualitative treatment of equation and discussion point energy. Angular momentum, R	amber of lectures = 13 mechanics, quantum fice and "particle-in-a- enberg Uncertainty print asion to two and three of f simple harmonic osc n of solution and wave igid rotator model of ro	B Title of the u mechanical operator box" (rigorous treat iciple; wave function limensional boxes, s illator model of vib functions. Vibration	unit: Quanta rs, Schroding ment), quant ns, probabili separation of rational mot nal energy of molecule, Se	um Chemis ger equation ization of er ty distributio variables, d ion: Setting f diatomic m paration of	try and its nergy levels on function egeneracy. up of Schro olecules an variables,	s, zero- s, ödinger nd zero-
Postulates of quantum application to free part point energy and Heise nodal properties, Exten Qualitative treatment of equation and discussion point energy. Angular momentum, R Spherical harmonics, D	amber of lectures = 13 mechanics, quantum micle and "particle-in-a- inberg Uncertainty primi- sion to two and three of of simple harmonic osc n of solution and wave igid rotator model of ro Discussion of solution.	8 Title of the u mechanical operator box" (rigorous treat iciple; wave function limensional boxes, s illator model of vib functions. Vibration otation of diatomic m	unit: Quant rs, Schroding ment), quant ns, probabili separation of rational mot nal energy of molecule, Se	um Chemis ger equation ization of er ty distributio variables, d ion: Setting f diatomic m paration of	try and its hergy level on function egeneracy up of Schro tolecules an variables,	s, zero- s, ödinger nd zero-
Postulates of quantum application to free part point energy and Heise nodal properties, Exten Qualitative treatment of equation and discussion point energy. Angular momentum, R Spherical harmonics, D Qualitative treatment of phasical polar appreciation	amber of lectures = 13 mechanics, quantum mice and "particle-in-a- inberg Uncertainty print ision to two and three of of simple harmonic osc n of solution and wave igid rotator model of re- Discussion of solution.	8 Title of the u mechanical operator box" (rigorous treat iciple; wave function limensional boxes, s illator model of vib functions. Vibration otation of diatomic m hydrogen-like ions:	unit: Quanti rs, Schroding ment), quant ns, probabili separation of rational mot nal energy of molecule, Se setting up o	um Chemis ger equation ization of er ty distributio variables, d ion: Setting f diatomic m paration of f Schrödinge	try and its hergy levels on function egeneracy up of Schro olecules an variables, er equation	s, zero- s, ödinger nd zero-
Postulates of quantum application to free part point energy and Heise nodal properties, Exten Qualitative treatment of equation and discussion point energy. Angular momentum, R Spherical harmonics, D Qualitative treatment of spherical polar coordin and most probable dist	amber of lectures = 13 mechanics, quantum mice and "particle-in-a- inberg Uncertainty prin ision to two and three of of simple harmonic osc in of solution and wave igid rotator model of re Discussion of solution. of hydrogen atom and hates, radial part, and quancas of electron from	8 Title of the u mechanical operator box" (rigorous treat iciple; wave function limensional boxes, s illator model of vib functions. Vibration otation of diatomic m nydrogen-like ions: uantization of energy	unit: Quanti rs, Schroding ment), quant ns, probabili separation of rational mot nal energy of molecule, Se setting up o y (only final	um Chemis ger equation ization of er ty distributio 'variables, d ion: Setting f diatomic m paration of f Schrödinge energy expr	try and its hergy levels on function egeneracy, up of Schro olecules an variables, er equation ression). A	s, zero- s, ödinger nd zero- in verage
Postulates of quantum application to free part point energy and Heise nodal properties, Exten Qualitative treatment of equation and discussion point energy. Angular momentum, R Spherical harmonics, D Qualitative treatment of spherical polar coordin and most probable dista	amber of lectures = 13 mechanics, quantum fice and "particle-in-a- onberg Uncertainty print asion to two and three of of simple harmonic oscentric of solution and wave igid rotator model of re- Discussion of solution. of hydrogen atom and hates, radial part, and quances of electron from	B Title of the u mechanical operator box" (rigorous treat iciple; wave function limensional boxes, s illator model of vib functions. Vibration otation of diatomic m hydrogen-like ions: lantization of energy the nucleus.	unit: Quanti rs, Schroding ment), quant ns, probabili separation of rational mot nal energy of molecule, Se setting up o y (only final	um Chemis ger equation ization of er ty distributio variables, d ion: Setting f diatomic m paration of f Schrödinge energy expr	try and its nergy levels on function egeneracy. up of Schro tolecules an variables, er equation ression). A	s, zero- s, ödinger nd zero- in verage
Postulates of quantum application to free part point energy and Heise nodal properties, Exten Qualitative treatment of equation and discussion point energy. Angular momentum, R Spherical harmonics, D Qualitative treatment of spherical polar coordin and most probable dista Unit-2	amber of lectures = 13 mechanics, quantum fice and "particle-in-a- inberg Uncertainty print asion to two and three of of simple harmonic osc n of solution and wave igid rotator model of re Discussion of solution. of hydrogen atom and hates, radial part, and quances of electron from amber of lectures = 08	8Title of the umechanical operatorbox" (rigorous treatbox" (rigorous treatuciple; wave functionlimensional boxes, sillator model of vibfunctions. Vibrationotation of diatomic mhydrogen-like ions:uantization of energythe nucleus.8Title of the uaspects only	unit: Quanti rs, Schroding ment), quant ns, probabili separation of rational mot nal energy of molecule, Se setting up o y (only final unit: Chemi	um Chemis ger equation ization of er ty distributio variables, d ion: Setting f diatomic m paration of f Schrödinge energy expr cal Bonding	try and its hergy levels on function egeneracy, up of Schro olecules an variables, er equation ression). A g (Qualitat	s, zero- s, ödinger nd zero- in verage ive
Postulates of quantum application to free part point energy and Heise nodal properties, Exten Qualitative treatment of equation and discussion point energy. Angular momentum, R Spherical harmonics, D Qualitative treatment of spherical polar coordin and most probable dista Unit-2 Nu Covalent bonding, vale	amber of lectures = 13 mechanics, quantum field and "particle-in-a- inberg Uncertainty print asion to two and three of of simple harmonic oscent of solution and wave igid rotator model of re- Discussion of solution. of hydrogen atom and hates, radial part, and quances of electron from amber of lectures = 08	8Title of the umechanical operatorbox" (rigorous treatciple; wave functionlimensional boxes, sillator model of vibfunctions. Vibrationotation of diatomic unydrogen-like ions:uantization of energythe nucleus.8Title of the uaspects onlyar orbital approache	unit: Quant rs, Schroding ment), quant ns, probabili separation of rational mot nal energy of molecule, Se setting up o y (only final unit: Chemi) s, LCAO-Mu	um Chemis ger equation ization of er ty distributio 'variables, d ion: Setting f diatomic m paration of f Schrödinge energy expr cal Bonding	try and its hergy levels on function egeneracy, up of Schro olecules an variables, er equation ression). A g (Qualitat	s, zero- s, ödinger nd zero- in verage ive
Postulates of quantum application to free part point energy and Heise nodal properties, Extern Qualitative treatment of equation and discussion point energy. Angular momentum, R Spherical harmonics, D Qualitative treatment of spherical polar coordin and most probable dista Unit-2 Nu Covalent bonding, vale and antibonding orbital	umber of lectures = 13 mechanics, quantum fice and "particle-in-a- inberg Uncertainty print asion to two and three of of simple harmonic oscent of solution and wave igid rotator model of re- Discussion of solution. of hydrogen atom and hates, radial part, and quances of electron from umber of lectures = 08 mice bond and molecula is. Qualitative extensio	STitle of the umechanical operatorbox" (rigorous treatciple; wave functionlimensional boxes, sillator model of vibfunctions. Vibrationotation of diatomic mhydrogen-like ions:uantization of energythe nucleus.BTitle of the uaspects onlyar orbital approachen to H2. Comparison	unit: Quanti rs, Schroding ment), quant ns, probabili separation of rational mot nal energy of molecule, Se setting up o y (only final unit: Chemi) s, LCAO-Men n of LCAO-I	um Chemis ger equation ization of er ty distributio variables, d ion: Setting f diatomic m paration of f Schrödinge energy expr cal Bonding O treatment MO and VB	try and its nergy levels on function egeneracy. up of Schro tolecules an variables, er equation ression). A g (Qualitat	s, zero- s, ödinger nd zero- in verage ive nding of H ₂
Postulates of quantum application to free part point energy and Heise nodal properties, Exter Qualitative treatment of equation and discussion point energy. Angular momentum, R Spherical harmonics, D Qualitative treatment of spherical polar coordin and most probable dista Unit-2 Nu Covalent bonding, vale and antibonding orbital only wave functions, or	amber of lectures = 13 mechanics, quantum fice and "particle-in-a- inberg Uncertainty print asion to two and three of of simple harmonic oscen of solution and wave igid rotator model of re- discussion of solution. of hydrogen atom and hates, radial part, and quances of electron from amber of lectures = 08 ence bond and molecular is. Qualitative extension detailed solution not real	STitle of the umechanical operatorbox" (rigorous treatciple; wave functionlimensional boxes, sillator model of vibfunctions. Vibrationotation of diatomic motation of diatomic mhydrogen-like ions:uantization of energythe nucleus.BTitle of the uaspects onlyar orbital approachen to H2. Comparisonquired) and their lim	unit: Quanti rs, Schroding ment), quant ns, probabili separation of rational mot nal energy of molecule, Se setting up o y (only final unit: Chemi) s, LCAO-Min n of LCAO-I nitations. Ou	um Chemis ger equation ization of er ty distributio variables, d ion: Setting f diatomic m paration of f Schrödinge energy expr cal Bonding O treatment MO and VB alitative des	try and its nergy levels on function egeneracy. up of Schro olecules an variables, er equation ession). A g (Qualitat of H_2^+ . Bo treatments cription of	s, zero- s, ödinger nd zero- in verage ive nding of H ₂
Postulates of quantum application to free part point energy and Heise nodal properties, Exter Qualitative treatment of equation and discussion point energy. Angular momentum, R Spherical harmonics, D Qualitative treatment of spherical polar coordin and most probable distant Unit-2 Nu Covalent bonding, vale and antibonding orbital only wave functions, of _CAO-MO treatment of	amber of lectures = 13 mechanics, quantum fice and "particle-in-a- inberg Uncertainty prim- usion to two and three of of simple harmonic osc n of solution and wave igid rotator model of re- Discussion of solution. of hydrogen atom and hates, radial part, and quances of electron from amber of lectures = 08 mice bond and molecula is. Qualitative extension detailed solution not re- of homonuclear and heter	8Title of the umechanical operatorbox" (rigorous treatbox" (rigorous treatciple; wave functionlimensional boxes, sillator model of vibfunctions. Vibrationotation of diatomic mhydrogen-like ions:cantization of energythe nucleus.8Title of the uaspects onlyar orbital approachen to H2. Comparisonquired) and their limteronuclear diatomic	unit: Quanti rs, Schroding ment), quant ns, probabili separation of rational mot nal energy of molecule, Se setting up o y (only final unit: Chemi) s, LCAO-M n of LCAO-I nitations. Qu	um Chemis ger equation ization of er ty distributio variables, d ion: Setting f diatomic m paration of f Schrödinge energy expr cal Bonding O treatment MO and VB alitative des (HF, LiH, C	try and its hergy levels on function egeneracy, up of Schro olecules an variables, er equation ression). A g (Qualitat of H_2^+ . Bo treatments cription of O, NO).	s, zero- s, ödinger nd zero- in verage ive nding of H ₂

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Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies.

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin spin coupling and high resolution spectra, interpretation of NMR spectra of organic molecules.

Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.Unit-4Number of lectures = 08Title of the unit: Photochemistry

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitized reactions, quenching. Role of photochemical reactions in biochemical processes, photo stationary states, chemiluminescence.

12. Brief Description of self-learning/ E - learning component

- 1. https://www.shodor.org/chemviz/overview/quantum.html
- 2. https://ocw.mit.edu/courses/chemistry/5-61-physical-chemistry-fall-2007/lecture-notes/
- 3. https://nptel.ac.in/courses/122101001/13

- Banwell, C. N. &McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw-Hill: New Delhi (2006), ISBN 978-9352601738
- 2. Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill (2001), ISBN 978-0074620540
- 3. House, J. E. Fundamentals of Quantum Chemistry 2nd Ed. Elsevier: USA (2004), ISBN 9780123567710
- 4. Lowe, J. P. & Peterson, K. Quantum Chemistry, Academic Press (2005), ISBN 978-0124575516
- Kakkar, R. Atomic & Molecular Spectroscopy: Concepts & Applications, Cambridge University Press (2015), ISBN 978-1107063884



2. Course Name	Quantum Chemistr	v Spectroscopy &	T	Т		P
Course manie	Photochemistry I ab			1		1
3 Course Code	17030521	0	0	0		1
4. Type of Course (u	se tick mark)	Core ()		AECO	SECO	GE ()
5. Pre-requisite	NA	6 Frequency	Even ()		Fither	Every
(if any)		(use tick marks)			Sem ()	Sem (
7. Total Number of I	Lectures, Tutorials, I	Practical				
Lectures = 0		Tutorials = 0		Practical =	52 hrs.	
8. Course Descriptio	n					
This course provides	practical training to ha	andle UV spectrophot	ometer and	study absorb	ance spect	ra of
various samples in the	visible range. Solution	ons of transition meta	l ions can be	colored (i.e	absorb v	isible
light) because d-electr	rons within the metal	atoms can be excited	from one ele	ctronic state	to another	r.
Organic compounds,	especially those with a	a high degree of conju	ugation, also	absorb light	t in the UV	or
visible regions of the	electromagnetic spect	rum. (Organic solven	ts may have	significant	UV absorpt	tion; no
all solvents are suitab	le for use in UV spect	roscopy. Ethanol abs	orbs very we	akly at most	twaveleng	ths.)
Solvent polarity and p	H can affect the absor	rption spectrum of or	ganic compo	unds.		
9. Course Objective	S					199
The objectives of this	course are to:					
1. Find out the u	inknown concentration	n of a sample and ver	ification of E	Beer-Lambe	rt's Law	
2. Determine co	ncentration of various	solutions using color	imetrv			
10. Course Outcome	s (COs)	8		/		
Upon successful com	pletion of this course.	the student will be ab	le to:			
1. Record the sn	ectra of different orga	nic compounds	10 10.			
2 Determine the	kinetics or rate const	tant of a chemical rea	ction			
11 List of Erraria	nta	tant of a chemical rea	CHOIT	and a start of the second		
II. LIST OF EXPERIME						
I Spectrophotome	nts				<u>,</u>	
I. Spectrophotome	etry	tro of KMnO and K	Cn Q (in Q 1	MUSON		
 Spectrophotome Study the 200-500 values Calcu 	etry onm absorbance specture the energies of the	tra of KMnO ₄ and K_2	Cr_2O_7 (in 0.1	M H ₂ SO ₄)	and determ	nine the
II. List of ExperimeI.Spectrophotome1.Study the 200-500 λ_{max} values. Calcu eV	etry) nm absorbance spec late the energies of th	tra of KMnO4 and K2 two transitions in d	Cr ₂ O ₇ (in 0.1 ifferent units	M H ₂ SO ₄) (kJ molecu	and determ le ⁻¹ , kJ mol	nine the l ⁻¹ , cm ⁻¹
I. Spectrophotome 1. Study the 200-500 λ_{max} values. Calcuel eV). 2. Study the pH-dep	etry) nm absorbance spec late the energies of the endence of the UV Vi	tra of KMnO ₄ and K_2 two transitions in d	Cr_2O_7 (in 0.1 ifferent units	M H ₂ SO ₄) (kJ molecu	and determ le ⁻¹ , kJ mol	nine the l ⁻¹ , cm ⁻¹
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I. Spectrophotome I. Spectrophotome 1. Study the 200-500 λ_{max} values. Calcue eV). 2. Study the pH-dep 3. Record the 200-32 acid) in water. Co II. 1. Verify Lambe solution of un 2. 2. Determine the 3. Study the kine 4. Determine the 5. Determine the 6. Study the kine 12. Brief Description 1. https://en.wikiped 2. https://cd1.edb.hk 13. Books Recommer 1. Mendham, J. Vog 2. Khosla, B. D.; Ga	and try and absorbance spect- and the energies of the endence of the UV-Vi- 50 nm UV spectra of the mment on the effect of colorimetry ert-Beer's law and deter known concentration the concentrations of KN etics of iodination of pre- e amount of iron preserved the dissociation constant etics of interaction of of self-learning/E - ia.org/wiki/Ultraviole mistry.msu.edu/facult 1.tw/~labcjw/BioPhyC edcity.net/cd/science/ nded el's Quantitative Cherr rg, V. C. & Gulati, A.	tra of KMnO ₄ and K ₂ the two transitions in d is spectrum (200-500 the given compounds of structure on the UV ermine the concentrat MnO ₄ and K ₂ Cr ₂ O ₇ in propanone in an acidie ent in a sample using t of an indicator (pher crystal violet/ phenoly learning componen tt%E2%80%93visible y/reusch/virttxtjml/sp Chem/Spectroscopy/b chemistry/s67chem/p mical Analysis, Pears , Senior Practical Phy	Cr ₂ O ₇ (in 0.1 ifferent units nm) of K ₂ Cr (acetone, aco 'spectra of o ion of CuSO a mixture. c medium. 1,10-phenant holphthalein) phthalein wit t 	M H ₂ SO ₄) (kJ molecu ² O ₇ . etaldehyde, rganic comp ⁴ /KMnO ₄ /K hroline. <u>h sodium hy</u> by s/uvspec.htr dination.pd BN 978-813 stry, R. Cha	and determ le ⁻¹ , kJ mol 2-propanol pounds. $_2$ Cr $_2$ O $_7$ in a 2/droxide. n f 1723258. nd & Co.: 1	nine the I ⁻¹ , cm ⁻¹ , acetic
I. Spectrophotome I. Spectrophotome 1. Study the 200-500 λ_{max} values. Calcurrely 2. Study the pH-dep 3. Record the 200-32 acid) in water. Co 1. Verify Lamberrely 3. Record the 200-32 acid) in water. Co 1. Verify Lamberrely 3. Record the 200-32 acid) in water. Co 1. Verify Lamberrely 3. Study the kine 3. Study the kine 4. Determine the 5. Determine the 6. Study the kine 12. Brief Description 1. https://en.wikiped 2. https://cd1.edb.hk 13. Books Recommer 1. Mendham, J. Vog 2. Khosla, B. D.; Ga Delhi (2011) ISBN State acide	etry 2) nm absorbance spect- alate the energies of the endence of the UV-Vi- 50 nm UV spectra of the mment on the effect of colorimetry ert-Beer's law and detain known concentration the concentrations of KM etics of iodination of pre- e amount of iron preserved e dissociation constant etics of interaction of the of self-learning/ E - ia.org/wiki/Ultraviole mistry.msu.edu/facult 1.tw/~labcjw/BioPhyC edcity.net/cd/science/ nded el's Quantitative Cherr rg, V. C. & Gulati, A. N 978-1906574000	tra of KMnO ₄ and K ₂ the two transitions in d is spectrum (200-500 the given compounds of structure on the UV ermine the concentrat MnO ₄ and K ₂ Cr ₂ O ₇ in propanone in an acidie ent in a sample using t of an indicator (pher crystal violet/ phenoly learning componen tt%E2%80%93visible y/reusch/virttxtjml/sp Chem/Spectroscopy/b chemistry/s67chem/p mical Analysis, Pears , Senior Practical Phy	Cr ₂ O ₇ (in 0.1 ifferent units nm) of K ₂ Cr (acetone, acc 'spectra of o ion of CuSO a mixture. c medium. 1,10-phenant holphthalein) phthalein wit t c_spectroscop ectrpy/uv-vi eerslaw.htm df/sDL_2_Icc on, 2009, ISI vsical Chemis	M H ₂ SO ₄) (kJ molecu ² O ₇ . etaldehyde, rganic comp 4/KMnO ₄ /K hroline. <u>h sodium hy</u> y s/uvspec.htr dination.pd BN 978-813 stry, R. Cha	and determ le ⁻¹ , kJ mol 2-propanol bounds. $_2$ Cr ₂ O ₇ in a vdroxide. n f 1723258. nd & Co.: 1	nine the I ⁻¹ , cm ⁻¹ , acetic A
 I. List of Experime Spectrophotome Study the 200-500 λ_{max} values. Calcurrev eV). Study the pH-dep Record the 200-33 acid) in water. Co I. Construction of the solution of un Determine the solution of un Determine the solution of un Determine the S. Determine the S. De	and sorbance spection of the UV-Vision of the terres of the UV-Vision of the terres of terres of the terres of terres	tra of KMnO ₄ and K ₂ the two transitions in d is spectrum (200-500 the given compounds of structure on the UV ermine the concentrat MnO ₄ and K ₂ Cr ₂ O ₇ in propanone in an acidic ent in a sample using t of an indicator (pher crystal violet/ phenoly learning componen tt%E2%80%93visible y/reusch/virttxtjml/sp Chem/Spectroscopy/b chemistry/s67chem/p mical Analysis, Pears , Senior Practical Phy	Cr ₂ O ₇ (in 0.1 ifferent units nm) of K ₂ Cr (acetone, acc 'spectra of o ion of CuSO a mixture. c medium. 1,10-phenant olphthalein) phthalein witt c_spectroscop ectrpy/uv-vi eerslaw.htm df/sDL_2_Icc on, 2009, ISJ	M H ₂ SO ₄) (kJ molecu 2O ₇ . etaldehyde, rganic comp 4/KMnO ₄ /K hroline. hroline. h sodium hy by s/uvspec.htr dination.pd BN 978-813 stry, R. Cha	and determ le ⁻¹ , kJ mol 2-propanol bounds. $_2$ Cr ₂ O ₇ in a $_2$ Cr ₂ O ₇ in a $_2$ droxide. n f 1723258. nd & Co.: 1	nine the l ⁻¹ , cm ⁻¹ , acetic
 I. List of Experime Spectrophotome Study the 200-500 λ_{max} values. Calcurrev eV). Study the pH-dep. Record the 200-33 acid) in water. Co I. Verify Lamberrev solution of un Determine the Study the kine Anters://en.wikiped https://cl1.edb.hkk Books Recommer Mendham, J. Vog Khosla, B. D.; Gardeling 	and the second s	tra of KMnO ₄ and K ₂ the two transitions in d is spectrum (200-500 the given compounds of structure on the UV ermine the concentrate MnO ₄ and K ₂ Cr ₂ O ₇ in propanone in an acidite ont in a sample using t of an indicator (pher crystal violet/ phenoly learning componen tt%E2%80%93visible y/reusch/virttxtjml/sp Chem/Spectroscopy/b chemistry/s67chem/p mical Analysis, Pears , Senior Practical Phy	Cr ₂ O ₇ (in 0.1 ifferent units nm) of K ₂ Cr (acetone, acc 'spectra of o ion of CuSO a mixture. c medium. 1,10-phenant phthalein with t 	M H ₂ SO ₄) (kJ molecu ² O ₇ . etaldehyde, rganic comp ⁴ /KMnO ₄ /K hroline. <u>h sodium hy</u> py s/uvspec.htr <u>dination.pd</u> BN 978-813 stry, R. Cha	and determ le ⁻¹ , kJ mol 2-propanol bounds. $_2$ Cr ₂ O ₇ in a $_2$ Cr ₂ O ₇ in a $_2$ droxide. n f 1723258. nd & Co.: 1	hine the l ⁻¹ , cm ⁻¹ , acetic



- Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003), ISBN 9780070570078.
- 4. Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003), ISBN 978-0716717355.

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1.	1. Name of the Department: Mathematics							
2.	Course	Vector	L		,	Г	Р	
	Name	Calculus						
3.	Course Code	17030522		1		0		0
4.	Type of Cours mark)	e (use tick	Core ()		DSE (🖋	AEC ()	SEC ()	OE ()
5.	Pre-requisite (if any)		6. Freq (use mar	luency tick ks)	Even ()	Odd (🖌	Either Sem ()	Every Sem()
7.	Total Number	of Lectures,	Tutorial	s, Practic	al			
Le	ctures = 52			Tutoria	$\mathbf{ls} = 0$	Practica	$\mathbf{l} = 0$	

8. Course Description:

Course in multivariable calculus. Topics include scalar and vector product, gradient divergence and curl; line and surface integrals; and the theorems of Green, Stokes, and Gauss.

9. Course Objectives:

After the course, the student will be able to:

- 1. To explain vector addition, dot product, cross product, scalar fields and vector fields.
- 2. To make students familiar with Curl, Divergence, Gradient and its properties.
- 3. To make students familiar with Theorems of Gauss, Green and Stokes and problems based on these theorems.
- 4. Scalar and vector quantities, Types of vector, Directional vector, Evaluate vector integration of Surface & Volume.

10. Course Outcomes (COs):

After completing this course, students will be able:

- 1. To understand the basics of dot product, cross product and length of vectors.
- 2. To introduce partial derivatives, derivatives of vector-valued functions, gradient functions.
- 3. To apply the basic concept of gradient, divergent, curl and their applications in the flow of water, heat.
- 4. To evaluate integrals of functions or vector-related quantities over curves, surfaces, and domains in two- and three-dimensional space.

11. Unit wise detailed content

Unit – 1 Number of lectures = 13 Title of the unit: Vector Algebra

Vectors and scalars, Definition of a vector and a scalar, Addition of vectors, Components of a vector, Dot product, Applications of the dot product, Cross product, Applications of the cross product, Scalar triple product, Vector triple product, Scalar fields and vector fields.

Unit – 2 Number of lectures = 13 Title of the unit: Vector Differential Calculus

Curves. Arc length. Curvature. Torsion, Functions of several variables, Gradient of a Scalar Field. Directional Derivative, Divergence, Curl and their geometric representation. Solenoidal and irrotational vectors.

Unit – 3 Number of lectures = 13 Title of the unit: Vector integral calculus

Line integral, Application of line integral, Work, Circulation, Independence of path and potential in a plane, Conservative vector field, Test for a conservative field, Evaluation of surface integrals, other forms of surface integrals, Volume integral, Introductory example of volume integral, Mass of an object with variable density.

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Unit – 4 Number of lectures = 13 Title of the unit: Integral Theorems

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Green's theorem, Stoke's theorem, Applications of Stokes's theorem, Related theorems linking line and surface integrals. Gauss-divergence theorem, Applications of the Divergence theorem, Related theorems linking surface and volume integrals.

12. Brief Description of self-learning/ E-learning component

- 1. <u>https://archive.nptel.ac.in/courses/111/105/111105122/</u>
- 2. https://archive.nptel.ac.in/courses/111/105/111105134/
- 3. https://www.coursera.org/learn/vector-calculus-engineers

- 1. Shanti Narayana and P.K. Mittal: A Text Book of Vector Analysis. S. Chand & Co., New Delhi 2010.
- 2. G.B. Thomas and R.L. Finney: Calculus, (9th ed.), Pearson Education, Delhi 2005.
- 3. H. Anton, I. Bivens and S. Davis: Calculus (10th ed.), John Wiley & Sons Inc., 2012.
- 4. P.C. Matthews: Vector Calculus, Springer, 2000.

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1. Name of th	e Depart	tment: Mather	natics				
2. Course Na	me	Vector	L		Τ	I	2
	(Calculus Lab					
3. Course Co	de	17030523	0		0	4	1
4. Type of Co	ourse (us	e tick mark)	Core ()	DSE (AEC ()	SEC	OE
		T				0	0
5. Pre-requis	ite		6. Frequency	Even ()	Odd ()	Either	Ever
(if any)			(use tick			Sem	y C
			marks)			0	Sem
7 Total Num	ber of L	ectures Tutor	ials Practical			1	
1. for al Num	Del UI L	cluics, iutor	Tutorials =	0	Practical =	= 52	
8. Course De	scription		I utoriuis	V	Tractical		
This course is	designed	to emphasize t	he knowledge of	vector calcu	ulus. Empha	asis is pla	ced o
evaluating grad	lient, div	ergence, curl,	line integration, s	urface inte	gration, vol	ume inte	gratio
etc. Upon cor	npletion,	students shou	ld be able to sel	lect and us	se appropria	ate mode	els an
techniques for	finding so	olutions to vector	or related problem	s.			
9. Course Ob	jectives:						1
1. To expl	ain vecto	r algebra conce	pts.				
2. To fam	iliarize ar	c length, curvat	ture and torsion en	tc.			
3. Applica	tion of lin	ne integral, surf	face integrals and	other forms	of surface i	integrals.	
4 To disc	uss the d	ivergence theo	rem of Gauss Sto	oke's theore	em and ann	lications	Stoke
theorem	1.	in engenee theo	ion of ourse, or		und upp	incutions	Store
10 Course Ou	tcomes (COs).					
			will be ables		· ·		
After completin	ng this co	urse, students v	will be able:				
1. To explain vectors and scalars, components of a vector, dot product, cross product,							
Scalar t	riple proc	luct, scalar field	ds and vector field	S .			
2. To expl	ain the D	irectional Deriv	vative.	1			
3. To dete	rmine sol	utions to curl a	nd angular velocit	y of vector	fields.		
4. To dete	rmine the	solution to flux	x integral and Stol	kes's theore	em.		
11. List of Pra	ctical's t	o perform in c	omputer lab usin	g software	MATLAB	•	
1. Evalua	te vector	addition and m	ultiplication.				
2. Evalua	te dot pro	duct, scalar tri	ple product.				
3. Evalua	te diverge	ence of a vector	r field.				
5 Evalua	te directio	a vector netu.					
6. Evalua	te curl an	d angular veloc	city of vector field				
7. Evalua	te the flux	x of a vector fie	eld.				
7. Evalua	te surface	e integral using	Stokes' theorem.				
9. Evalua	te flux in	tegral.					
10. Evalua	te flux of	a vector field u	ising Divergence t	theorem.			
12. Brief Desc	ription o	f self-learning	/ E-learning com	ponent			
1. <u>https://i</u>	n.mathwo	orks.com/help/r	matlab/ref/diverge	nce.html			
2. <u>https://i</u>	n.mathwo	orks.com/help/i	natlab/ref/curl.htn	<u>nr?s_tid=do</u>	<u>c_ta</u>		
13 Books Dec	ommond	orks.com/help/t	natiad/vector-nelo	is.ntml			
13. DOUKS KEC	ommend				/	1	
Murch	fre	alik.	k	D	C-S-	Lette	
1							



1. Brian H. Hann, Daniel T. Valentine, Essential MATLAB for Engineers and Scientists (7th ed.), Academic Press Inc., 2019.

2. Amos Gilat: MATLAB: An Introduction with Applications (8th ed.), John Wiley & Sons Inc, 2016.

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1. Name of the Department: Mathematics							
2. Course	Operations	I	7	Т			
Name	Research		1			r	
3. Course	17030524				0		
Code		4			0		
4. Type of Cou	rse (use tick	Core ()	DSE	A	SEC ()	OE ()	
mark)			(1)	E			
			(•)	C			
				0			
5. Pre-		6. Frequency	Even ()	Odd	Eith	Eve	
requis		(use tick		(1)	er	ry	
ite		marks)		(•)	Sem	Sem	
(if any)			i li i i i i i i i i i i i i i i i i i		0	0	
7. Total Numbe	er of Lectures, T	utorials, Practical					
Lectures = 52		Tutorials = 0		Practica	$\mathbf{l} = 0$		
8. Course Desc	ription:		- Augeria				
Operations Rese world problems	earch is a science by using math	e of modeling and c ematics, statistics, a	optimization and comput	which he ers. The	lps to mod course dea	el real- ls with	

methods to solve linear programming problems. This course also deals with duality theory in linear programming. Various applications of linear programming such as transportation, assignment and game problems are discussed in this course. Another class of problems, namely sequencing problems, is also introduced in this course.

9. Course Objectives:

This module aims to introduce students to use quantitative methods and techniques for effective decision making; model formulation and applications that are used in solving decision making problems.

10. Course Outcomes (COs):

After completing this course, students will be able:

- 1. To formulate and solve linear programming problems for a physical situation like production, distribution of goods and economics and solve them by graphical method.
- 2. To solve a LPP by simplex, Big-M and two phase methods.
- 3. To analyze the problem of transporting the products from origins to destinations with least transportation cost and solve it.
- 4. To understand the basic concept of Game theory and sequencing problems.

11. Unit wise detailed content

Unit – 1	Number of lectures = 10	Title of the unit: Linear Programming
<u> </u>	1 1.	

Operation research and its scope, Necessity of operations research in industry, Linear programming problems: Formulation and graphical solution, Convex sets, Convex linear combination, Convex hull, Hyper plane.

Unit – 2	Number of lectures =	Title of the unit: Simplex Method and Duality
	15	Theory

Basic solution, Degenerate solution, Fundamental theorem of linear programming, Simplex method, Big-M and Two Phase methods, Dual simplex method, Duality in linear programming, Weak duality theorem, Basic duality theorem, Fundamental theorem of duality. nalik

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Unit – 3	Number of lectures = 15	Assignment Problem
Linear pro	ogramming formulation of tra	ansportation problem, Initial basic feasible solution by
north-wes	t corner, least-cost and Voge	el's approximation method, Test for optimality,
Transport	ation algorithm (MODI Metl	hod), Unbalanced transportation problem, Mathematical
formulatio	on of assignment problem, H	ungarian assignment method.
Unit – 4	Number of lectures = 12	Title of the unit: Game theory & Sequencing
Two-perso	on zero- sum games, Pure str	rategies, Saddle points, Minimax-Maximin principle,
Mixed stra	ategy games, Solution of mix	ked strategy games by graphical and linear programming

methods, Problem of sequencing, Optimal sequencing algorithm, Processing n jobs through 2 machines.

12. Brief Description of self-learning / E-learning

component

- 1. <u>https://www.youtube.com/watch?v=VNr4wGJTeSE</u>
- 2. https://www.youtube.com/watch?v=a2QgdDk4Xj
- 3. https://www.youtube.com/watch?v=ziHfSkOhAmg
- 4. <u>https://www.youtube.com/watch?v=BUGIhEecipE</u>
- 5. <u>https://www.youtube.com/watch?v=RnZnIIksdwU</u>
- 6. https://www.youtube.com/watch?v=h0bdo06qNVw
- 7. https://www.youtube.com/watch?v=533dp83Er6E

- M.S. Bazaraa, J.J. Jarvis and H.D. Sherali: Linear Programming and Network Flows (4th ed.), John Wiley & Sons, 2010
- K. Swarup, P.K. Gupta and M. Mohan: Operations Research (15th ed.), Sultan Chand & Sons, 2010.
- 3. H. A. Taha: Operations Research: An Introduction (10th ed), Pearson, 2017.
- 4. G. Hadley: Linear Programming (5th ed.), Narosa Publishing House, 2002.

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1. Name of the	e Department: M	athematics				
2. Course	Operations	T	т	•	D	
Name	Research Lab	L			P	
3. Course	17030525	0	0		4	
Code			and the second	ALL ALLAND		
4.Type of Cour	rse (use	Core ()	DSE	A	SEC ()	OE ()
tick mark)			1.1	E		
				C		
				0		
5.Pre-		<u>6.</u>	Even ()	Odd	Either	Every
requisit	Section 1.	Frequen		(1)	Sem ()	Sem
e (if		cy (use tick			1	0
any)		marks)				<u> </u>
7.Total Numbe	er of Lectures, Tu	itorials, Practical				
Lectures = 0		Tutorials = 0		Practica	l = 52	
8.Course Desci	ription:					
Operations Reso	arch is a science	of modeling and onti	imization I	t allows	you to mad	al real
world problems	by using mathem	paties statistics and	computers	It provi	des vou to	ols and
theories to solve	these real-world	problems by finding	the optim	al solutio	ues you to	model's
subject to const	raints of time la	bor resource mater	ial and by	siness mi	les In this	course
various software	s has been intro.	duced which holps of	tudents to	solve L:	es. In this	mmina
nrohlem using G	ranhical as well as	algebraic methods	tudents to	Solve LI	ical riogra	mining
problem using O	rupinear as well as	argeorate methods.				
9.Course Obie	ctives:					
This module	aims to enhanc	e student computat	ional capa	abilities	in solving	linear
programming pr	roblems. Lengthy	and tedious calculati	ons involve	ed in Sim	plex, Big-N	1 and 2
Phase Method	can be done with	nin seconds using so	ftware like	TORA.	Students c	an also
compare differe	ent methods that	are used to find th	he initial b	asic feasi	ible solutio	on of a
I ransportation p	problem.					
10.Course Out	comes (COs):		14			
After completin	g this course, stud	lents will be able to:				
Salvalingen				1.41		TLAD
solve linear pro	gramming problem	ins using softwares lik	ke IORA, I	viathemat	ica and MA	ILAB.
11 T' CD					•	
11. List of Pra	actical's to perfor	m in computer lab u	Ising TOR	A		
1. To deterr	nine the solution of	of a linear programmi	ng problem	by granh	ical method	1
2. To analyz	ze the behavior of	the solution of a LPP	by changing	19 coeffic	ients in the	
constrain	ts for a fixed obje	ctive function	oy enangi	ig coemie	ients in the	
3. To solve	the LPP by simple	ex method and dual si	mplex met	hod		
4. To solve	the LPP by two n	hase method	mpier men			
5. To solve	the LPP by Rig M	method				
6. Determin	e the basic feasible	e solution of a transp	ortation pro	blem by t	he north-w	est
corner me	ethod.	in the provide statistics of the provide sta	er and pre	Siem by t	no north-w	
7. Determin	e the basic feasibl	e solution of a transp	ortation pro	blem by I	east-cost m	ethod
8. Determin	e the basic feasibl	e solution of a transp	ortation pro	blem by Y	Vogel's	
approxim	ation method	e solution of a transpo	or anon pre	Joint Oy		
9. Determin	e the ontimal solu	tion of a transportation	n problem			
10 Determin	e the optimal solu	tion of an assignment	nrohlem			
0 m	e ne optiliar solu	and of all assignment	problem.	/ 1		
IN -	O LK.		_ /	- /		
n	ma	La	D	C.S. Lal	yee	
/		A		00		



11. Brief Description of self-learning / E-learning component

- 1. https://www.youtube.com/watch?v=kavYLZatz44
- 2. <u>https://www.youtube.com/watch?v=WSfro4frQY</u>
- 3. <u>https://www.youtube.com/watch?v=ufYtueq2Dw</u>

- 1. H. A. Taha: Operations Research: An Introduction (10th edition), Pearson, 2017.
- 2. S.K. Mishra and B. Ram: Introduction to Linear Programming with MATLAB, CRC Press, 2017.
- 3. I. Stanimirović: Advances in Optimization and Linear Programming, Apple Academic Press, 2022.
- 4. D. C. Vella: Invitation to Linear Programming and Game Theory, Cambridge University Press, 2021.

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1. Name of the D	epartment: Mathema	itics				
2. Course	Special Functions	L		Т		P
Name						
3. Course Code	17030526	4		0		0
4. Type of Cours	e (use tick mark)	Core ()	DSE	AEC ()	SEC	OE ()
			()		0	
5. Pre-requisite		6.Frequency	Even	0116	Either	Every
(if any)		(use tick	0		Sem	Sem ()
(marks)	U		0	
7. Total Number	of Lectures, Tutorial	s. Practical				
Lectures $= 52$	or Deerures, ruteriu	Tutorials = 0	1	Practical =	0	
8. Course Descri	ption:	Tutoriulo		- ructicui	•	
This course is de difficult problems variable coefficie Different types of	esigned to describe the s of differential equati ent with and the diffic f special functions are a	different types o ons. Emphasis is sult integrations a llso understood an	f tools/o placed o nd soluti d applied	perators to on different ion of diffe l in real life	solve the ial equation rential e problem	e various ions with quations. is.
9. Course Object	tives:				1	
Students that succ 1. Know abor- points. 2. Know abor- 3. Understand properties. 4. Know abor- problems in 10. Course Outc	cessfully complete this ut the series solution it beta and gamma func I Gauss hypergeomet ut orthogonality and sp n terms of Bessel funct omes (COs):	course will be abl of differential eq etions and their pro- cric and confluen pecial types of fun- ions.	e to: uations a operties. nt hyper nction an	about ordir geometric id apply the	nary, and function em to sol	singular and its lve many
After completing 1. To investigat 2. To understa integrals. 3. To discuss C and expand v 4. To apply the Bessel's equ 11. Unit wise det	g this course, students we te a series solution of d nd beta and gamma Gauss hypergeometric a various functions in terr concept of series solut ation.	will be able to: ifferential equatio functions and ap and confluent hype ms of hypergeome ion and discuss th	ns with v oply ther ergeometr etric func- e solutio	ariable coe n to solve ric function tion. n of Legend	fficients. various and its p dre's equ	definite properties ation and
Unit – 1 Numł	per of lectures $= 13$	Title of the un	it: Series	Solutions		
Ordinary point	Singular point Types	of singular point	Differe	ential equat	ion with	singular
point Regular an	d irregular singular noi	nt Series solution	of secon	d order diff	ferential e	equatione
using Power serie	s method and Froheniu	is method	or secon		erentiar (quations
Unit - ? Numb	per of lectures = 13	Title of the up	it. Funct	ions Defin	ed by Inf	finite
		Integrals	n. Funct	ions Denno		
Beta function, Pro relations, Relation Gamma functions	operties and various for n between Beta and Ga s.	rms, Gamma funct mma function, Ev	tion, Rectaluation	urrence form of integrals	nula and using Be	other eta and
Unit – 3 Numb	per of lectures = 13	Title of the un	it: Hype	rgeometric	Functio	ns
verter	foralili	640	/	c.s.h	lte	



Gauss hypergeometric equation, Solution of Gauss hypergeometric equation, Gauss Hypergeometric function and its properties, Integral representation, Gauss formula, Linear transformation formulas, Contiguous function relations. Differentiation formulae, Linear relation between the solutions of Gauss hypergeometric equation, confluent hypergeometric function and its properties, Integral representation Kummer's first transformation.

Unit -4Number of lectures = 13Title of the unit: Legendre and Bessel FunctionsLegendreequation and its solution, Legendre functions and their properties, Recurrencerelations and generating functions, Orthogonality of Legendre polynomials, Rodrigues' formulaforLegendrepolynomials.Bessel equation and its solution, Bessel functions and theirproperties, Recurrence relations and generating functions, Rodrigues' formula, Orthogonality ofBessel functions, Expansion of functions in terms of Lagendre and Bessel function.

12. Brief Description of self-learning / E-learning component

- 1. https://www.youtube.com/watch?v=9_m36W3cK74
- 2. https://www.youtube.com/watch?v=p0tCauMh6Q8
- 3. http://web.mst.edu/~lmhall/SPFNS/spfns.pdf

- Erwin Kreyszig: Advanced Engineering Mathematics (10th ed.), John Wiley & Sons, New York, 2011.
- 2. I.N. Sneddon: Special Functions of Mathematical Physics & Chemistry (3rd ed.), Longman Higher Education, 1980.
- 3. W.W. Bell: Special Functions for Scientists and Engineers, Dover Publications, 2013.

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1. Name of the De	epartment: Math	hematics				6
2. Course Name	Special	L		Τ		P
	Function Lab			<u></u>		
3. Course Code	17030527	0		0		4
4. Type of Course	(use tick	Core ()	DSE (🖌	AEC ()	SEC	OE ()
5 Dro roquisito		6 Eroquonov	Even ()		0 Fither	Evonu
5. rre-requisite (if any)		o. Frequency	Even	Odd ()	Sem	Sem ()
(II any)		(use tick marks)				Sem
7. Total Number	of Lectures. Tut	orials. Practical				
Lectures = 0		Tutorials =	0	Practical =	= 52	1.00
8. Course Descrip	otion:					
This course is desig	ned to emphasize	e the knowledge of	f special fur	nctions. Emp	phasis is j	placed or
gamma and beta fu	inctions, Bessel f	function zeros, or	thogonal po	lynomials.	Upon co	mpletion
students should be	able to select	and use appropr	ate models	and techn	iques to	r finding
9 Course Objection	nal polynomials,	series solutions o	i differentia	l equations.		
1 The interpla	v between Fuler'	s integral of gamp	a function	and propert	ies of het	and
gamma func	tions.	s integrar of gamm	na runction	and propert		a and
2. To investiga	te and derive the	properties of hype	ergeometric	functions.		
3. To study the	properties of spe	ecial functions as v	well as ortho	ogonal poly	nomials.	
4. To know the	e certain specific	systems of orthogo	onal polyno	mials and th	neir prope	rties.
10. Course Outcon	nes (COs):					
After completing th	is course student	s will be able:				
Arter completing th		is will be able.				
1. To evaluate	various definite i	ntegrais.				
2. To investiga	te Bessel function	n zeros.				
3. To determin	e solutions to ort	hogonal polynomi	als.			
4. To determin	e the solution in t	terms of a series o	f differentia	l equations.		
11. List of Practical	's to perform in c	computer lab using	software N	ATLAB		
1. Evaluate Be	ssel function zero	os.			-	
2. Evaluate ort	hogonal polynom	ials				
3. Evaluate zer	os of orthogonal	polynomials.			-	
4. Evaluate hy	pergeometric fund	ction.				
5. Evaluate Le	gendre polynomia	als.				
6. Evaluate He	rmite polynomial	ls.				
7. Evaluate bet	a and gamma fur	octions.				
8. Evaluate Ga	uss's multiplicati	ion theorem				
9. Evaluate ser	ies solution of di	fferential equation	S.			
10. Evaluate rec	urrence relations)				
14 0 1 40	0.101	(1.1
12. Brief Descripti	on of self-learnin	ng / E-learning co	mponent	h 1. C		
1. <u>https://in.ma</u> 2. https://in.ma	thworks.com/ma	tlabcentral/fileexc	hange/6/94	-bessel-tune	ction-zero	<u>DS</u>
orthogonaln	olvnomials?s tid	=srchtitle	nange/0795			
3. https://in.ma	ithworks.com/ma	tlabcentral/fileexc	hange/4693	0-first-deriv	vative-of-	normal-
associated-le	egendre-polynom	ials?s_tid=srchtitl	e			
0/ 0	0:12			1		
w h	nati	100	12	othe		
0 10		Kare	C.J.K.	dur -		
/		4				



- 1. Wolfgang Schweizer: Special Functions in Physics with MATLAB, Springer Cham, 2021.
- 2. Amos Gilat: MATLAB: An Introduction with Applications (8th ed.), John Wiley & Sons Inc, 2016.

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SEMESTER-VI (DSE)



1.	Name of the De	partment: Physic	S			5	
2.	Course Name	Sensors and	L		Τ		Р
		Detectors					and the
3.	Course Code	17030601	3		0		0
4.	Type of Course	e (use tick mark)	Core ()	DSE ()	AEC	SEC $()$	GE ()
5.	Pre-requisite		6. Frequency	Even $()$	Odd ()	Either	Every
	(if any)		(use tick marks)			Sem ()	Sem ()
7.	Total Number	of Lectures, Tuto	rials, Practical				
-	Lectures = 40		Tutorials =	0 Pi	ractical =	= 0	
8	Course Descrip	tion	Tutoriais		actical	V	

The syllabus is divided into four units. First two units introduction to sensors and types of sensors cover the basics of sensors and various sensors used in technology in detail. Last two units basic processes involved in radiation detectors and Detection techniques elaborate the concept of development of various types of radiation detectors using the process involved in interaction of radiation with matter.

9. Course Objectives:

This course is designed to enhance the students' knowledge about sensors and detectors. The students will learn about the basics of sensors, their properties, various types of sensors and their applications. Also they will learn about basic processes involved in radiation detectors, their characteristics and various types of detection techniques developed to detect the charged particles and gamma radiation.

10. Course Outcomes (COs):

After the successful completion of the course, students would be able to

1. Explain the basic of sensors and their properties.

2. Explain the principle, construction, working and applications of various types of sensors.

3. Explain the basic processes used to detect radiation and characteristics of detectors

 Explain the principle, construction, working and applications of various types of charged particle and gamma radiation detection systems.

11. Unit wise detailed content

Unit-1 Number of lectures = 10 Title of the unit: Introduction to Sensors

Introduction, Human Body as a sensor system, Sensors in an Automobile, Classification of Sensors, Gas sensor, Sensor as a passive or active element, The sensor as part of a measurement system, Sensor Properties, Response time, Recovery time, Reproducibility, Stability, Sensitivity and resolution, dynamic range, selectivity, Historical development of sensors, Sensor system.

Unit – 2 Number of lectures = 10 Title of the unit: Types of sensors

Electrochemical Sensors, Conductimetric sensors, semiconductor sensors, chemi resisters, electrochemical gas sensors, Piezoelectric sensors, types of piezoelectric sensors, FIbre Optic Sensors, Thermal sensors, resistance thermometers, Magnetic Sensors, Applications.

Unit – 3 Number of lectures = 10 Title of the unit: Basic processes involved in radiation detectors

Basic Nuclear processes in radioactive sources, alpha decay, beta decay, gamma emission, Interaction of Radiation with matter: Energy loss due to ionization (Bethe-Block formula), energy



loss of electrons and positrons, Cerenkov radiation, interaction of Photons, interaction of neutrons. Characteristics of a detector, Sensitivity, detector response, energy resolution, fano factor and the response function, response time, detector efficiency, dead time, errors.

Unit – 4 Number of lectures = 10 | Title of the unit: Detection techniques

Principle of Gas detectors, Ionization chamber, proportional counter, GM Counter, Semiconductor Detectors (Si &Ge) for charge particle and photon detection, ΔE -E detector telescopes, Short ΔE -E time of flight spectroscopy, Modem Gas Detectors: Basic principle and operation of split anode ionization chamber, Position sensitive ionization chamber, Multi-wire proportional counter, Scintillation detectors, photo-multiplier tube (PMT).

12. Books Recommended

 Introduction to Sensors by John Vetelino and Aravind Reghu, CRC Press, 1st edition (2 August 2010), Taylor & Francis Group), ISBN-13: 978-1439808528;

- An Introduction to Sensors and Instrumentations by Shobh Nath Singh, Alpha Science International Ltd (30 June, 2017), ISBN-13: 978-1783322626;
- Introductory nuclear Physics by Kenneth S, Krane (Wiley India Pvt, Ltd., 2008), ISBN-978-8126517855;
- Techniques for Nuclear and Particle Physics Experiments by W.R. Leo, Springer; 2nd rev. ed. 1994 edition (25 February 1994), ISBN-13: 978-3540572800;
- 5. Radiation detection and measurement, G,F, Knoll (John Wiley & Sons, 2000). ISBN: 978-0-470-13148-0.

13. Online links

- 1. Pressure, Force, Motion, and Humidity Sensors by James Zweighaft and Jay Mendelson, offered by University of Colorado Boulder on Coursera https://www.coursera.org/learn/pressure-force-motion-humidity-sensors
- Sensor Manufacturing and Process Control Sensors by James Zweighaft and Jay Mendelson, offered by University of Colorado Boulder on Coursera https://www.coursera.org/learn/sensor-manufacturing-process-control
- Sensors and Actuators By Prof. Hardik Jeetendra Pandya, IISc Bangalore, <u>https://onlinecourses.nptel.ac.in/noc21_ee32/preview</u>

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2.	Course Name	Physics Modeling using Python			Τ		LT		L T		Р
3.	Course Code	17030602	3		0		0				
4.	Type of Co mark)	ourse (use tick	Core ()	DSE ()	AEC ()	SEC (√)	GE ()				
5.	Pre- requisite (if any)		6. Frequenc y (use tick marks)	Even (√)	Odd ()	Either Sem ()	Every Sem ()				
7.	Total Num	ber of Lectures, Tu	utorials, Practic	al							
	Lectures =	40	Tutoria	ls = 0	Practical	= 0					
8.	Course De	scription:									

makes it easy to adapt for students who have little or no programming experience. It aims to provide students with an understanding and importance of the computation and its application in solving problems and simulation.

9. Course Objectives:

1. Provide an introduction to the Python programming language.

2. Basic Numerical Analysis Using Python

3. Plot data using appropriate Python visualization libraries.

10. Course Outcomes (COs):

1. To have basic understanding of Python and be able to design, code, and test small programs.

2. Be fluent in the use of procedural statements assignments, conditional statements, and loops.

3. Basic Libraries, Matplotlib, Maths, Numpy, Pandas

4. Basics of Pygame, Turtle and Simpy

11. Unit wise detailed content

III Chie i	ibe actuited content	
Unit-1	Number of lectures = 10	Title of the unit: Introduction to Python and
		Development Environment

Introduction: Features of Python, syntax, dynamic typing, built in object types, numerous libraries and tools, chronology and uses, installation of anaconda, installing and Using Jupyter Notebook.

Unit – 2	Number of lectures = 10	Title of the unit: Parts of Python Programming
and the second second		Language

Simple data-types: integer, float, string, Introduce the notion of a variable, and methods of manipulation, data types and operators: accepting input from the console, assignment, statement, expressions, operators and their precedence.

Unit - 3 Number of lectures = 10 Title of the unit: Basic Syntax and Loop

Identifiers, keywords, integer and string values, identifiers, user input, string formatting, expressions and arithmetic - expressions, conditional statements, Boolean expressions, if/else

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statement, other conditional expressions, iteration, Loops, introduction to using functions, functions and modules, introduction to MATPLOTLIB, the plot function, subplots, dimensional plotting

Unit - 4	Number of lectures = 10	Title of the unit: Introduction to Libraries and Basic
		Statistics and Probability

Plotting library, Matplotlib, seaborn, data manipulation library Pandas, array interface library, Numpy, basic data analysis like mean, median, mode, variance etc. using Numpy library, pygame, turtle and simpy for basic simulations.

12. Books Recommended

- 1. The Python Tutorial (https://docs.python.org/3/tutorial/)
- 2. Code Academy Python Track (http://www.codecademy.com/tracks/python)
- 3. Python 101 (http://www.blog.pythonlibrary.org/2014/06/03/python-101-book-published-today/)
- 4. Python Practice Book: https://anandology.com/python-practice-book/index.html

13. Online Links

1. Python Crash Course' by Eric Matthews

2. A Byte of Python: free eBook: https://github.com/swaroopch/byte-of-python/releases/latest

3. Learn Python the Hard Way' by Zed A. Shaw

- 4. Discrete event simulation for Python [https://simpy.readthedocs.io/en/latest/examples/index.html]
- 5. Making Games with Python & Pygame Kindle Edition by A Sweigart [https://inventwithpython.com/pygame/]
- 6. https://realpython.com/beginners-guide-python-turtle/

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1. Name of the D	epartment: Physics				-			
2. Course Name	Satellite	L		T			P	
	Communication &							
	its applications	1		1				
3. Course Code	17030603	3		0			0	1
4. Type of Cours	e (use tick mark)	Co	ore ()	DS	SE ()	SEC (<i>b</i>
5. Pre-requisite	Basic knowledge of	6.	Frequency	Ev	en	Odd	Either	Every
(if any)	Antennas and		(use tick	0		(1)	Sem	Sem ()
	Digital		marks)				0	
	Communication	1.1		14				
7. Total Number	of Lectures, Tutorial	s, P	Practical					
Lectures = 40		Tu	itorials = 0	196	Pr	actical	l = 0	
S. Course Descrip	ption:		1					
The course includ	les, the basics of satelli	tec	orbits, satellite link	c de	sign	and s	egments	,
methods of sate	ante access and applica	atio	ns of satellite com	nmu	nica	ation.		
J. Course Object	tives:	-						
1 Tanal	tand the basis of the	1:2	. 1					
1. 10 underst	tand the basics of safel	inte	orbits.					
2. To unders	and the satellite link d	esig	gn & segment.					
J. To underst	tand the applications of	or s	atennite access.					
10 Course Outer	and the applications of	i sa	iennes.		-			
At the set of the	······································							
At the end of the c	course, the students she	ould	t be able to:					
1. Analyze th	e satellite orbits.							
2. Understand	d the earth segment an	d sr	pace segment.					
3. Demonstra	te the various methods	s of	satellite access.					
4. Design var	rious satellite application	ons						
II. Unit wise deta	alled content							
	$\frac{1}{10000000000000000000000000000000000$		the of the unit: S	Sate	ellit	e Orbi	ts	
Kepler's Laws, or	rbital parameters, orbit	al p	erturbations, stations	on l	keep	ing, ge	eo station	nary and
non-Geo-stationar	y orbits – Look Angl	e D	Determination- Lin	nits	of	visibil	ity -ecli	pse-Sub
satellite point –Su	n transit outage-Launc	hin	g Procedures - lau	nch	veł	nicles a	and prop	ulsion.
Unit - 2 Nu	mber of lectures = 12	1	fitle of the uni	t:	Sate	ellite	link de	sign &
		S	Segments					
Basic transmission	theory, system noise	tem	perature and G/T	rati	0, D	esign	of down	links,
ıp link design, De	sign of satellite links f	or s	pecified C/N, Sys	tem	des	sign ex	ample.	,
Space Segments:	Power supply units, al	titu	de control, station	kee	epin	g, ther	mal cont	rol,
TT&C, transponde	ers, antenna subsystem	(el	ementary ideas).					
Earth Segment: F	Receive – Only home 7	W s	systems (TVRO) -	- 01	utdo	or UN	IT – Ind	oor
JNIT for analog (FM) TV – Master ante	nna	TV system (MAT	ΓV)	- 0	Commu	inity Ant	enna
TV system (CATV	/) – Transmit – Receiv	e ea	arth stations (elem	ent	ary	ideas)		
Unit-3 Nu	mber of lectures $= 8$	T	itle of the unit: S	Sate	llite	Acces	SS	
requency division	n multiple access (FD	M	A) Intermodulatio	n, (Calo	ulation	n of C/N	I. Time
livision Multiple	Access (TDMA) Fran	ne s	structure, Example	es.	Sate	llite S	witched	TDMA
Onboard processin	ng, DAMA, Code Div	visi	on Multiple acces	ss (CD	MA).S	pread si	pectrum
ransmission and re	eception.					-,,-	1	
Jnit – 4 Nu	imber of lectures = 10	T	itle of the unit. S	ato	llite	Annli	cations	
	initial of feetures - 10	1	ine of the unit: S	ale	mie	Appli	cations	
		-)	1	
	1/1	Y	L D	e	J	_	Mide	M
	Xð	P	10				Um	XZ
	/ 🕅						1	5
								V



Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB), Business TV (BTV), GRAMSAT, Specialized services – E –mail, Video conferencing, Internet.

12. Brief Description of self-learning / E-learning component

- 1. <u>https://www.toppr.com/guides/physics/communication-systems/satellite-communication/</u>
- 2. https://sites.pitt.edu/~dtipper/2720/2720_Slides17.pdf
- 3. <u>https://www.accessengineeringlibrary.com/content/book/9780071462983/chapter/chapter14</u>
- 4. https://link.springer.com/referenceworkentry/10.1007/978-1-4419-7671-0 91

13. Books Recommended

Text Book:

1. Dennis Roddy, "Satellite Communication", Fourth Edition, McGraw Hill International, 2006.

Reference Books:

Satellite Communications, Timothy Pratt, Charles Bostian and Jeremy Allnutt, 2nd Edition, John Wiley & Sons, 2003.

2. Satellite Communication Systems Engineering, W. L. Pitchand, H. L. Suyderhoud, R. A. Nelson, 2nd Ed., Pearson Education., 2007.

Other References:

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.

2. N. Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.

3. Bruce R. Elbert, "Satellite Communication Applications", Hand Book, Artech House Bostan London, 1997.

4. Emanuel Fthenakis, "Manual of Satellite Communications", McGraw Hill Book Co., 1984.

5. Robert G. Winch, "Telecommunication Transmission Systems", McGraw-Hill Book Co., 1983.

6. M. Richharia, "Satellite Communication Systems-Design Principles", Macmillan 2003.

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	Pharmaceutical Chemistry	L	-	Γ	P	
3. Course Code	17030604	3)	0	
4. Type of Course	(use tick mark)	Core ()	DSEO	AECO	SEC()	GEO
5 Pre-requisite	NA	6 Frequency	Even	044.0	SEC (V)	Eurom
(if any)	INA	(use tick marks)	Even	Odd ()	Som ()	Every
7 Total Number	of Lootunog Tutoniala Duo	(use tick marks)	(•)		Selli ()	Sem (
7.10tal Number 0	Tutorials = 0		Desetter	1_0		<u></u>
8 Course Descrip	Tutoriais – 0		Practica	1=0		
The findings on dr infections have alv	rug design and development vays remained at the forefron	in oncology, cardio nt of cutting edge m	ovascular o edical res	lisease, an earch. The	d bacterial a ere is utmost	and vira deman
understanding of understand the me	medicinal chemistry and ph dicinal and pharmacological	armacology. This c	ourse will	l offer am	iple opportu	a good nities to
9. Course Objecti	ves		ar for drug	designing	•	
The objectives of t	his course are to:				1	
1. Introduce the a	aspect of drug discovery, desi	gn and developmen	t.			
2. Describe the d	istinctive element of drug me	etabolism.				
3. Create an und	lerstanding of the synthesis	of representative d	lrugs of c	lasses. e.	z., analgesic	agents
antipyretic age	nts, anti-inflammatory agents	s, antibiotics etc.	U		,	
4. Explain aerobi	c and anaerobic fermentation	and its use in the pr	roduction	of selected	products.	
5. Detailed mecha	anism of action of therapeutic	cs.				
10. Course Outco	mes (COs)					
Upon successful co	ompletion of this course, the	student will be able	to:	Service Providence		
1. Understand the	e exciting aspects of drug disc	covery, design and d	levelopme	nt.		
2. Recognize repr	resentative classes of drugs, e	e.g., analgesic agents	s, antipyre	tic agents,	antibiotics e	etc.
3. Understand the	e mode of action, synthesis a	and metabolism of s	selected m	edicines a	nd Vitamins	via th
fermentation p	rocess.					
11. Unit wise deta	iled content					
Unit-1	Number of lectures = 10	Title of the unit: 1	Drug Desi	gn and D	rug Metabo	lism
Biotransformation,	Factors Affecting Drug Meta	abolism, Pathway of	Drug Me	tabolism-I	Phase-I, Phas	se-II and
conjugation Reacti	on, Significance of Drug Met	tabolism in Medicina	al Chemis	try: A gen	eral study of	Physio
Disignatoriam Con	es related to biological act	ivities. Stereochem	istry and	Drug Act	tion. Isosteri	sm and
Bioisosterism, Con	cept of Lead Compound. Con	mputer-Aided Drug	Design an	d Molecu	lar Modeling	5.
Cunt-2	Number of lectures = 10	litle of the unit: I	Vledicinal	Chemisti	·y – 1	
Analgosias antiny	presentative drugs of the folio	owing classes:				
Analgesics, antipy	matio & anti inflammatan		D 41 * 1*	0.1.		
Daragatamal Anla	retic & anti-inflammatory	agents: Morphine, 1	Pethidine,	Codeine,	Methadone,	Aspirin
Paracetamol, Anlag	retic & anti-inflammatory gen, Dextropropoxphene, Per	agents: Morphine, I ntazocine, ibuprofen	Pethidine,	Codeine,	Methadone,	Aspirin
Paracetamol, Anlag Antibiotics: Penic	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphon	agents: Morphine, 1 ntazocine, ibuprofen enicol, Cephalospori	Pethidine, in, Chloror	Codeine, 1 mycetin ar	Methadone, nd Streptomy	Aspirin vcin.
Paracetamol, Anlag Antibiotics: Penic Antibacterial and	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphon Lignocaine, Proceine, Panz	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho	Pethidine, in, Chloror oxazol, Su	Codeine, i mycetin ar lphacetam	Methadone, nd Streptomy ide, Trimeth	Aspirin vcin. oprim
Paracetamol, Anlag Antibiotics: Penic Antibacterial and Local Anesthetics Antiviral agents:	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphona : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCL	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine	Pethidine, in, Chloror oxazol, Su	Codeine, mycetin ar lphacetam	Methadone, nd Streptomy ide, Trimeth	Aspirin vcin. oprim
Paracetamol, Anlag Antibiotics: Penic Antibacterial and Local Anesthetics Antiviral agents: Central Nervous	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphona : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenoharbita	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related of I Diazenam	Pethidine, in, Chlorot oxazol, Su drugs: AZ	Codeine, mycetin ar lphacetam T- Zidovu	Methadone, nd Streptomy ide, Trimeth dine	Aspirin vcin. oprim
Paracetamol, Anlag Antibiotics: Penic Antibacterial and Local Anesthetics Antiviral agents: Central Nervous S Unit-3	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphona : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenobarbita Number of lectures = 10	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related o I, Diazepam.	Pethidine, in, Chlorodoxazol, Su drugs: AZ	Codeine, mycetin ar lphacetam T- Zidovu	Methadone, nd Streptomy ide, Trimeth dine	Aspirin vcin. oprim
Paracetamol, Anlag Antibiotics: Penic Antibacterial and Local Anesthetics Antiviral agents: A Central Nervous S Unit-3	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphona : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenobarbita Number of lectures = 10	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related o I, Diazepam. <u>Title of the unit: N</u> sification of Cardio	Pethidine, in, Chlorotoxazol, Su drugs: AZ Medicinal	Codeine, 1 mycetin ar lphacetam T- Zidovu Chemistr	Methadone, nd Streptomy ide, Trimeth dine <u>y – II</u>	Aspirin vcin. oprim
Paracetamol, Anlag Antibiotics: Penic Antibacterial and Local Anesthetics Antiviral agents: A Central Nervous S Unit-3 Cardiovascular D Action uses and si	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphona : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenobarbita Number of lectures = 10 Prugs: Introduction and clas deseffects of Amyl Nitrate S	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related o I, Diazepam. Title of the unit: M sification of Cardio orbitrate, Varanami	Pethidine, in, Chlorot oxazol, Su drugs: AZ Medicinal ovascular	Codeine, 1 mycetin ar lphacetam T- Zidovu Chemistr Diseases,	Methadone, nd Streptomy ide, Trimeth dine y – II Synthesis, N	Aspirin ccin. oprim
Paracetamol, Anlag Antibiotics: Penic Antibacterial and Local Anesthetics Antiviral agents: Central Nervous S Unit-3 Cardiovascular D Action, uses and sin Drugs acting on C	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphona: Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenobarbita Number of lectures = 10 Prugs: Introduction and clas de-effects of Amyl Nitrate, S ardiovascular System: Card	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related o I, Diazepam. <u>Title of the unit: N</u> sification of Cardio orbitrate, Verapamil	Pethidine, in, Chloror oxazol, Su drugs: AZ Medicinal ovascular l, and Ater	Codeine, 1 mycetin ar lphacetam T- Zidovu Chemistr Diseases, nolol.	Methadone, nd Streptomy ide, Trimeth dine y – II Synthesis, N	Aspirin cin. oprim Mode o
Paracetamol, Anlag Antibiotics: Penici Antibacterial and Local Anesthetics Antiviral agents: Central Nervous S Unit-3 Cardiovascular D Action, uses and sin Drugs acting on C Anti-Hypertensive	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphon : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenobarbita Number of lectures = 10 Prugs: Introduction and clas de-effects of Amyl Nitrate, S ardiovascular System: Card Anti-Hyperlinidemic drugs	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related o l, Diazepam. <u>Title of the unit: N</u> sification of Cardio orbitrate, Verapamil liac glycosides, Anti	Pethidine, in, Chlorotoxazol, Su drugs: AZ Medicinal ovascular l, and Ater -Arrhythm	Codeine, 1 mycetin ar lphacetam T- Zidovu Chemistr Diseases, nolol. nic agents,	Methadone, nd Streptomy ide, Trimeth dine y – II Synthesis, M Anti-Angina	Aspirin vcin. oprim Aode o
Paracetamol, Anlag Antibiotics: Penic Antibacterial and Local Anesthetics Antiviral agents: Central Nervous S Unit-3 Cardiovascular D Action, uses and si Drugs acting on C Anti-Hypertensive, Unit-4	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphon : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenobarbita Number of lectures = 10 Prugs: Introduction and clas de-effects of Amyl Nitrate, S ardiovascular System: Card Anti-Hyperlipidemic drugs. Number of lectures = 10	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related o I, Diazepam. <u>Title of the unit: N</u> sification of Cardio orbitrate, Verapamil liac glycosides, Anti	Pethidine, in, Chlorot oxazol, Su drugs: AZ Medicinal ovascular l, and Ater -Arrhythm	Codeine, 1 mycetin ar lphacetam T- Zidovu Chemistr Diseases, nolol. nic agents,	Methadone, nd Streptomy ide, Trimeth dine y – II Synthesis, N Anti-Angina	Aspirin ccin. oprim Aode o
Paracetamol, Anlag Antibiotics: Penic Antibacterial and Local Anesthetics Antiviral agents: A Central Nervous S Unit-3 Cardiovascular D Action, uses and si Drugs acting on C Anti-Hypertensive, Unit-4 Antimalarial Drug	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphona : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenobarbita Number of lectures = 10 Prugs: Introduction and clas de-effects of Amyl Nitrate, S ardiovascular System: Card Anti-Hyperlipidemic drugs. Number of lectures = 10 s: Chloroquine Primaguing	agents: Morphine, I intazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related o I, Diazepam. Title of the unit: M sification of Cardio orbitrate, Verapamil liac glycosides, Anti Title of the unit: M	Pethidine, in, Chlorotoxazol, Su drugs: AZ Medicinal ovascular l, and Ater -Arrhythm Medicinal	Codeine, 1 mycetin ar lphacetam T- Zidovu Chemistr Diseases, nolol. nic agents, Chemistr methonein	Methadone, nd Streptomy ide, Trimeth dine y – II Synthesis, N Anti-Angina y – III	Aspirin ccin. oprim Aode o
Paracetamol, Anlag Antibiotics: Penic Antibiotics: Penic Antibiacterial and Local Anesthetics Antiviral agents: Central Nervous S Unit-3 Cardiovascular D Action, uses and si Drugs acting on C Anti-Hypertensive, Unit-4 Antimalarial Drug Antineoplastic drug	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphona : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenobarbita Number of lectures = 10 Prugs: Introduction and clas de-effects of Amyl Nitrate, S ardiovascular System: Card Anti-Hyperlipidemic drugs. Number of lectures = 10 gs: Chloroquine, Primaquine, ugs: Actinomycin Azathiopr	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related o I, Diazepam. <u>Title of the unit: N</u> sification of Cardic orbitrate, Verapamil liac glycosides, Anti <u>Title of the unit: N</u> , Pyrimethamine, Quine Busulphan Chl	Pethidine, in, Chloror oxazol, Su drugs: AZ Medicinal ovascular l, and Ater -Arrhythm Medicinal unine, Tri	Codeine, 1 mycetin ar lphacetam T- Zidovu Chemistr Diseases, nolol. nic agents, Chemistr methoprin	Methadone, nd Streptomy ide, Trimeth dine y – II Synthesis, N Anti-Angina y – III h.	Aspirin ccin. oprim Mode o al drugs
Paracetamol, Anlag Antibiotics: Penici Antibacterial and Local Anesthetics Antiviral agents: Central Nervous S Unit-3 Cardiovascular D Action, uses and si Drugs acting on C Anti-Hypertensive, Unit-4 Antimalarial Drug Antineoplastic drugs	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphon : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenobarbita Number of lectures = 10 rugs: Introduction and clas de-effects of Amyl Nitrate, S ardiovascular System: Card Anti-Hyperlipidemic drugs. Number of lectures = 10 gs: Chloroquine, Primaquine, ugs: Actinomycin, Azathiopr : Adrenaline, Noradrenaline	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related o I, Diazepam. <u>Title of the unit: N</u> sification of Cardio orbitrate, Verapamil liac glycosides, Anti <u>Title of the unit: N</u> , Pyrimethamine, Qu ine, Busulphan, Chl Salbutamol, Terbut	Pethidine, in, Chloror oxazol, Su drugs: AZ Medicinal ovascular l, and Ater -Arrhythm Medicinal unine, Tri oramubuc	Codeine, 1 mycetin ar lphacetam T- Zidovu Chemistr Diseases, nolol. nic agents, Chemistr methoprin il, Cisplati	Methadone, nd Streptomy ide, Trimeth dine y – II Synthesis, M Anti-Angina y – III n, Methotres	Aspirir oprim Aode o al drugs kate
Paracetamol, Anlag Antibiotics: Penici Antibacterial and Local Anesthetics Antiviral agents: Central Nervous S Unit-3 Cardiovascular D Action, uses and si Drugs acting on C Anti-Hypertensive, Unit-4 Antimalarial Drug Antineoplastic drugs	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphona : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenobarbita Number of lectures = 10 Prugs: Introduction and clas de-effects of Amyl Nitrate, S ardiovascular System: Card Anti-Hyperlipidemic drugs. Number of lectures = 10 gs: Chloroquine, Primaquine, igs: Actinomycin, Azathiopr : Adrenaline, Noradrenaline,	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related o d, Diazepam. <u>Title of the unit: N</u> sification of Cardio orbitrate, Verapamil liac glycosides, Anti <u>Title of the unit: N</u> , Pyrimethamine, Qu ine, Busulphan, Chl Salbutamol, Terbuta	Pethidine, in, Chloror oxazol, Su drugs: AZ Medicinal ovascular l, and Ater -Arrhythm Medicinal unine, Tri oramubuc aline, Epho	Codeine, 1 mycetin ar lphacetam T- Zidovu Chemistr Diseases, nolol. nic agents, Chemistr methoprin il, Cisplati edrine	Methadone, ad Streptomy ide, Trimeth dine y - II Synthesis, M Anti-Angina y - III n, Methotres	Aspirir oprim Aode o al drugs sate
Paracetamol, Anlag Antibiotics: Penici Antibiotics: Penici Antibacterial and Local Anesthetics Antiviral agents: Central Nervous S Unit-3 Cardiovascular D Action, uses and si Drugs acting on C Anti-Hypertensive, Unit-4 Antimalarial Drug Antineoplastic drugs	retic & anti-inflammatory gen, Dextropropoxphene, Per illin, Ampicillin, Chloramphe antifungal agents: Sulphona : Lignocaine, Procaine, Benz Acyclovir, Amantadine HCl, System agents: Phenobarbita Number of lectures = 10 Frugs: Introduction and clas de-effects of Amyl Nitrate, S ardiovascular System: Card Anti-Hyperlipidemic drugs. Number of lectures = 10 s: Chloroquine, Primaquine, igs: Actinomycin, Azathiopr : Adrenaline, Noradrenaline,	agents: Morphine, I ntazocine, ibuprofen enicol, Cephalospori amides; Sulphanetho ocaine HIV-AIDS related o I, Diazepam. <u>Title of the unit: N</u> sification of Cardio orbitrate, Verapamil liac glycosides, Anti <u>Title of the unit: N</u> , Pyrimethamine, Qu ine, Busulphan, Chl Salbutamol, Terbuta	Pethidine, in, Chlorotoxazol, Su drugs: AZ Medicinal ovascular l, and Ater -Arrhythm Medicinal unine, Tri oramubuc aline, Epho	Codeine, 1 mycetin ar lphacetam T- Zidovu Chemistr Diseases, nolol. nic agents, Chemistr methoprin il, Cisplati edrine	Methadone, nd Streptomy ide, Trimeth dine y – II Synthesis, M Anti-Angina y – III n, Methotres	Aspirir ccin. oprim Aode o al drugs sate



Diagnostic Agents: Lopanoic Acid, Propyliodone, Sulfobromopthalein-sodium, Indigotindisulfonate, Indigo Carmine, Evans blue, Congo Red, Fluorescein Sodium.

Aerobic and anaerobic fermentation. Production of Ethyl alcohol and citric acid, Vitamin B2, Vitamin B12 and Vitamin C.

12. Brief Description of self-learning/ E-learning component

- 1. https://www.fpharm.uniba.sk/uploads/media/Seminar_1_from_Pharmaceutical_chemistry_I_02.pdf
- 2. http://library.umac.mo/ebooks/b28050332.pdf
- 3. https://www.mheducation.co.uk/openup/chapters/9780335243976.pdf
- 4. http://www.d.umn.edu/~jfitzake/Lectures/MedSchool/Downloads/2006HistopathAntineoplasticsI.pdf

- 1. G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press, U.K.ISBN-10: 9780199697397
- 2. Hakishan, V.K. Kapoor: Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi. ISBN-10: 8185731772
- 3. William O. Foye, Thomas L., Lemke, David A. William: Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd. New Delhi. ISBN 10: 0683033239

Ab



1. Name of the De	epartment: Chemistry					
2. Course Name	Chemistry of Cosmetics &	L		Г	P	
	Perfumes		1.18			
3. Course Code	17030605	3		0	0	
4. Type of Course	e (use tick mark)	Core ()	DSE ()	AEC ()	SEC (√)	GE ()
5. Pre-requisite	NA	6. Frequency	Even	Odd ()	Either	Every
(if any)		(use tick marks)	()		. Sem ()	Sem ()
7. Total Number	of Lectures, Tutorials, Prac	ticals				
Lectures = 40	Tutorials = 0	Practical = 0			an an sa	
3. Course Descrip	otion					
This course provid	les training in chemistry with	h applications in pe	erfumery a	and cosme	tic science.	You will
have an integrated	learning experience where y	ou will build a stro	ong chemi	stry found	ation and ap	ply you
cnowledge in spec	ific applications using your s	enses.				
). Course Objecti	ves			1		
The objectives of t	his course are to:					
1. Understand th	e science behind Perfumes an	nd Cosmetics.		0.1		
2. To understand	the various safety testing me	ethods to evaluate the	he quality	of the pro	ducts.	
3. To understand	the preparation methods of s	several Perfumes an	id Cosmet	ICS.		
U. Course Outco	mes (COs)					
1 To discover of	ompletion of this course, the s	student will be able	to:			
1. To discover so	sofety of assentias and parf	or numan beauty				
2. To deliver the	history and science of cosm	unes.				
1 Unit wise deta	iled content	ettes and periumes.			1.	
Init_1	Number of lectures $= 10$	Title of the unit:	Chemistr	v of Cosm	otios & Dor	fumos
General methods o	f preparation and application	s of the following c	osmetics	Hair dya	hair spray s	hampoo
suntan lotions fac	e powder lipsticks talcum	powder nail enam	el creamo	(cold va	nishing and	shaving
creams) antinersn	irants and artificial flavours	Essential oils and	their imr	ortance ir	cosmetic i	adustria
nclude Eugenol (Feraniol sandalwood oil euc	alvotus rose oil 2-	nhenvl eth	vl alcohol	Jasmone a	nd Cive
Moscone.	Jeramon, sandarwood on, ede	alyptus, 10se oli, 2-	phenyreu	ly raiconor	, jasinone, a	nu cive
Unit-2	Number of lectures = 10	Title of the unit:	Physical	properties	of Cosmeti	c
		compounds				
Physical Properties	s of materials potentially used	d in cosmetics. Diel	ectric con	stant, inclu	uding polari	zation of
non-polar molecule	es refractive index, molar refra	action, optical activi	ity, interfa	cial tension	n, cohesion,	adhesion
and spreading adso	orption at solid/liquid and soli	id /gas interfaces an	d their app	olications	n cosmetics	
Unit-3	Number of lectures = 10	Title of the unit:	Cosmetic	Necessitie	es	4
Acids, Bases, Buff	ers, Topical agents. Protectiv	es and antimicrobia	ls, Astring	gents. Cher	mistry of em	ulsions
n cosmetic formul	ation and importance of bran	ched-chain compou	inds in cos	metics. Ha	azards in che	mistry
aboratories and ne	cessary precautions					
Unit-4	Number of lectures = 10	Title of the unit:	Herbal C	osmetics		
Study of the source	es, characters, chemical const	ituents, identificatio	on test & c	osmetic us	es of Lipids	- Casto
oil, Linseed oil, O	live oil, Arachis Oil, Sesame	e oil, Coconut oil, o	chaulmoog	gra Oil, sh	ark liver oil	, kokun
outter, lanolin.						
12. Brief Descript	ion of self-learning/ E-learn	ing component		A THE REAL PROPERTY OF		
1. https://nptel.ac.in	n/courses/103107082/module	e4/lecture1/lecture1.	.pdf			
2. https://youtu.be/	GcfNQXk4-g8					
3. https://youtu.be/	vFdyJKfFwwg					
4. https://youtu.be/	GShqaPLndho					
5. http://nopr.nisca	ir.res.in/bitstream/123456789	9/27249/1/IJPAP%2	052%283	%29%201	83-191.pdf	1.1.1.1.2
13. Books Recom	mended					
4	A	tal	Al			

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- Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. U.K. (1990). ISBN-10: 0134573188; 1. ISBN-13: 978-0134573182
- Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi. ISBN-10: 9352160002
 Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).ISBN-10 : 8182838290.

to



2. Course Name	Pesticide Chemistry	L		Т		Р	
3. Course Code	17030606	3		0		0	
4. Type of Course	(use tick mark)	Core ()		DSE ()	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Freq	uency	Even (Odd ()	Either	Every
(if any)		(use tic	k marks)			Sem ()	Sem ()
7. Total Number of	f Lectures, Tutorials, Pr	acticals	-				
Lectures = 40		Tutoria	ls = Nil	Pra	ctical = N	il	Galler .
8. Course Descript	ion						
This course provide	s training on pesticide and	d their appl	ications. It	will leverage	e students	with scientif	fic
insight in synthesizi	ng pesticides, their chemi	ical propert	ies, and use	age to help u	isers apply	their knowl	edge in
specific applications	s using their senses.			a Aire			
9. Course Objectiv	ves						
The objectives of th	is course are to:						
1. Understand the	science behind pesticides	•					
2. Understand the	classification and chemic	al nature of	pesticides	•			
3. Understand the	synthetic methods of vari	ous pesticio	les.			<u></u>	
10. Course Outcon	nes (COs)	. 1					
Upon successful con	npletion of this course, th	he student w	ill be able	to:			
2. Provide the im	sage of pesticides.						
2. Flovide the ini	portance of pesticides.				· · · · · · · · · · · · · · · · · · ·		
11. Unit wise detail	ed content	10					
Unit-1	Number of lectur	res = 10	Title of the	ne unit: Pest	ticide class	sification ar	nd
Pasticidas (natural a	nd synthetic) bonefits De	asticidas al	Cnemica	nature	miaal mater		
toxicity and action	Processes for manufacturi	ing insection	ides funci	on use, chei	nical natul	re, formulati	on,
Unit_?	Number of lectur	ros = 10	Title of t	he unit: Syn	thosis one	Tashnisal	
onic 2	rumber of feetur	10	manufac	ture of nest	icides	1 Technical	
uses of representativ Gammexene); Organ (Chloranil), Anilide Unit-3 Pesticides and pollu Management, Soil & (like blue baby synd	ve pesticides in the follow nophosphates (Malathion, s (Alachlor and Butachlor Number of lectur tion of the soil, water, Pest & Water Pollution from Fe Irome)	ving classes , Parathion) r). res = 10 sticide hand ertilizers, E	: Organoch ; Carbama Title of t lling practi utrophicati	lorines (DD' tes (Carbofu he unit: Pes ces to protec on, diseases	T, Lindane ran and ca ticides Pol t groundw due to ove	e, Aldrin, Die rbaryl); Quir Ilution ater, Pesticie ruse of ferti	eldrin, nones de lizers
Unit-4	Number of lectur	•es = 10	Title of t	he unit: Bio	pesticides		
Biopesticides, Weed	licides (Anilophos, Butac	hlor, Diuro	n, 2,4-D, F	luchlorallin,	Glyphosat	te, Isoprotur	on,
Paraquat dichloride)	, Plant Growth Regulator	(Alpha naj	ohthalene a	cetic acid, C	hloromequ	uat chloride)	,
Fumigants (Alumini	umphasphide, Ethylene b	promide, M	ethyl bromi	ide), New G	eneration I	nsecticides,	Insect
Growth Regulators ((IGRS)					· · · ·	1
12. Brief Descriptio	on of self-learning/ E-lea	rning com	ponent				
1. https://nptel.ac.in/	courses/104103020/26	1.0/1		10			
2. https://nptel.ac.in/	courses/10310/082/modu	ule9/lecture	1/lecture I.	pdf			
4. https://en.wikkiped	lia.org/wiki/Biopesticide						
13 Books Bocomm	onded	<u></u>					
 Cremlyn, R. Pes 0471996319 	ticides. Preparation and N	Modes of A	ction, John	Wiley & Sc	ons, New Y	ork, 1978.I	SBN 10
2. Ohkawa. H, Miy ISBN: 97835273	vagawa. H and Lee. P. W. 316632	. Pesticide (Chemistry,	Wiley-VCH	Verlag G	mbh & Co.2	007.
M	A why	t9-	2	Ash	2 .		


1. Name of the D	epartment: Mathem	atics	· * *			
2. Course	Cryptography	L	(Γ	P	
Name					4	
3. Course Code	17030607	3		0	0	
4. Type of Cours	se (use tick mark)	Core ()	DSE ()	AEC ()	SEC ()	OE ()
5. Pre-requisite		6. Frequency	Even (Odd ()	Either	Every
(if any)		(use tick marks)			Sem ()	Sem ()
7. Total Number	of Lectures, Tutoria	lls, Practical	····	·		
Lectures = 40		Tutorials = 0	Prac	tical = 0	<u></u>	
8. Course Descri	ption:	the contraction in the former		•	111 0	
called cinhertext	Only those who posse	transforming it (ener	ypting it)	lecrupt) the	message in	ormat is
text. Cryptographi	ic systems digital si	gnatures etc. are used	to protect	e-mail me	ssages cre	dit card
information, and co	orporate data.	Sindures ete ure used	to protect	e man, ma	135ages, ere	card card
9. Course Object	tives:					
The objectives of t	his course are to:					
1 To dovelop	skills and knowledge	af standard same arts in				
	skins and knowledge	of standard concepts in	cryptograp	пу		
2. To demons	trate the role of crypto	ography in the present di	gital world.			
3. To understa	and how to deploy enc	ryption techniques to se	cure data in	transit acro	oss data net	works.
4. To design s	security applications in	the field of information	n technolog	y.		
10. Course Outco	mes (COs):					
After completing th	his course students wi	ill ha ahlar	· · · · · · · · · · · · · · · · · · ·			
Alter completing th	his course, students wi	in de able:				
1. To develop	a framework to under	stand and implement cr	yptographic	concepts.		
2. To acquire	knowledge of standard	d algorithms that can be	used to pro	vide confid	entiality, in	tegrity
3 To encrypt	and deepwrt messages	using block sinhers ins	luding data	and advana	ad an amount :	
standard ()FS & AFS) public ke	ev cryptosystems (RSA	FlGamal)	and advanc	ed encrypti	on
4. To enhance	the ability to analyze	a problem, and identify	and define	the comput	ing requirer	nents
for data sec	curity		una actinic	une comput	ing requirer	nenes
11. Unit wise deta	iled content					
Unit – 1 Nu	mber of lectures = 8	Title of Unit-I: Ov	verview of (Cryptograp	ohy	
Cryptology, Comp	uter security concepts	, Security attacks, Cryp	tanalysis an	nd brute-for	rce attack, (Classical
Ciphers: Substituti	on ciphers- Caesar ci	pher, Mono-alphabetic	ciphers, Pla	yfair ciphe	r, Hill ciphe	er, Poly-
alphabetic ciphers-	Vigenere Cipher, One	-time pad.				
Unit - 2 Nu	mber of lectures $= 12$	Title of Unit-II: Sy	ymmetric H	Key Crypto	graphy	1
their composition	Stream cipher and blo	number generator, Sur	ostitution Cl	phers, Perr	nutation cip	ther and
Data Encryption St	tandard (DFS) DFS e	xample Triple DES Ac	tvanced En	cryption St	and reista	S) AES
transformation fun	ctions. AES key exp	ansion. AES example.	Hash Func	tions Mess	age Auther	ntication
Code (MAC).					uge maner	litication
Unit - 3 Nu	mber of lectures = 10	Title of Unit-III: N	Number the	eory in Cry	ptography	
Basics of Number	theory: Divisibility, 1	Modular arithmetic and	set of resid	lue (Z_n) , F	ermat's and	l Euler's
theorems, GCD, I	Euclidean algorithm,	Extended Euclidean al	gorithm, P	rime numb	ers, Euler's	s totient
function, Primali	ty testing, Galois fie	elds $(GF(p) and GF(2))$	ⁿ)), Primi	tive root, I	Discrete log	garithms,
Polynomial arithm	etic: Addition, multipl	ication and division ove	r Galois fie	ld.		
•	. 1			/		
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W	ma	1th/	V c	5. Lalike	-	



Unit - 4	Number of lectures = 10	Title of Ur	nit-IV: Public l	Key Cry	ptography		
Public key c	ryptosystems, Hybrid cryptosys	tem, Diffie-	Hellman key en	xchange,	Man-in-the	-middle	attack,
The RSA a	lgorithm and security of RSA	A, Elgamal	cryptosystem,	Digital	signatures,	Elliptic	curve
cryptograph	y, Lattice based cryptography.			· · · ·		4	

12. Brief Description of self-learning / E-learning component

- 1. <u>https://www.youtube.com/watch?v=iTVyKbDCJrA&list=PLgMDNELGJ1CbdGLyn7OrVAP-IKg-0q2U2&index=1</u>
- 2. https://www.youtube.com/watch?v=Q-HugPvA7GQ&list=PL71FE85723FD414D7
- 3. <u>https://www.youtube.com/watch?v=1plMO7ChXMU&list=PLJ5C_6qdAvBFAuGoLC2wFGruY_E2</u> gYtev

13. Books Recommended

- 1. J. Hoffstein, J. Pipher and J. H. Silverman: An Introduction to Mathematical Cryptography (2nd ed.), Springer, 2014.
- 2. N. Koblitz: A Course in Number Theory and Cryptography, Springer, 2012.
- 3. A. J. Menezes, P. C. van Oorschot, S. A. Vanstone: Handbook of Applied Cryptography, CRC Press, 1996.
- 4. J. A. Buchmann: Introduction to Cryptography (2nd ed.), Springer, 2013.
- 5. D. R. Stinson and M. B. Paterson: Cryptography Theory and Practice (4th edition), Chapman Hall / CRC 2019.

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1.	Name of the D	epartment: Mathe	ematics				
2.	Course	Integral	T	_ T	,		D
	Name	Equations	L	() (1			F
3.	Course	17030608	3	0			0
_	Code						
4.	Type of Cours	se (use tick mark)	Core ()	DSE ()	AEC ()	SEC	OE ()
						()	
5.	Pre-		6. Frequency	Even (Odd ()	Either	Every
	requisite		(use tick			Sem	Sem ()
	(if any)		marks)			0	
7.	Total Number	of Lectures, Tuto	rials, Practical				
Lee	etures = 40		Tutorials = 0	Pra	ctical = 0		
8.	Course Descri	ption:				4	
Thi	s course covers	s Fredholm and Vo	lterra integral equa	tions and th	heir solution	ons using	y various
met	thods such as N	leumann series, rese	olvent kernels, Eule	er's equation	n, variation	nal deriva	ative and
inv	ariance of Euler	's equations.					
9.	Course Object	tives:					
The	objectives of t	his course are to:				Call Sector 1	
1	Give an accord	nt of the foundation	of internal and	one and al	aulus - C	uist:-	and (1 .
1.	applications in	mathematics:	is of integral equation	ons and cal	culus of va	riations	and their
2	Solve simple i	nitial and houndary	waluo anaklama ha		.1		
2.	Solve simple I	finitial and boundary	value problems by	using sever	al variable	calculus	•
10.	Course Outco	mes (COs):					
Aft	er completing th	his course, students	will be able:			•	
1	To understand	different kinds of F	Fredholm and Volter	ra integral e	quations		
2	To know the o	ancent of orthonor	nol systems of function	tions in Into	quations.	iana	
2.	To know the c		al systems of funct	·	grai equat	ions	
3.	To apply the h	nethods of calculus	of variations in phy	sics and eng	gineering.		
4.	To understand	the basic concept o	t canonical transfor	mations.			
11.	Unit wise deta	iled content					
Uni	it – 1 Numbe	er of lectures = 12	Title of the unit:	Definition	s, Classific	cations a	nd
			Eigenfunctions of	t Integral E	quations		
Def	initions of int	tegral equations a	nd their classifica	tion, Relat	ion betwe	een integ	gral and
diff	erential equation	ons, Fredholm inte	gral equations of	second kin	nd with se	eparable	kernels,
Kec	ative schemes	tem of algebraic eq	uations. Eigenvalue	es and eiger	ntunctions.	, Iterated	kernels,
Rec	alive scheme 1	Application of iterat	in integral equation	on of secon	id Kind (I	veumann	series),
ILES		application of iterat	Title fill	ina s integr	arequation	1 of secon	id kind.
Un	II – 2 Numbe	er of lectures = 8	Title of the unit:	Hilbert Sch	midt The	ory	
Hill	bert Schmidt th	neory, Symmetric l	kernels, Orthonorm	al systems	of functio	ons. Fund	lamental
pro	perties of Eige	envalues and eiger	ntunctions for syn	nmetric kei	nels. Solu	ation of	integral
equ	ations by using	Hilbert Schmidt the	eory.				
Uni	it – 3 Numbe	er of lectures $= 8$	Title of the unit:	Calculus of	Variation	15	1
Intr	oduction to ca	lculus of variation	s, Review of basic	e multi-vari	iable calcu	ulus, Con	nstrained
max	kima and minin	na, Lagrange multi	pliers. The Euler-L	agrange equ	uation. Va	riational	problem
witl	h moving bound	laries: Transversalit	y conditions, one si	ded variatio	ons.		
	Hu a	0 0:10			1		

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Unit - 4	Number of lectures $= 12$	Title of the	unit: Exti	remum and (anonical	
		Transforma	ations			
General d	efinitions, Jacobi condition,	Weierstrass	function,	Legendre con	ndition, Pri	nciple of
least actio	n, Lagrange's equation from	Hamilton's	principle.	Canonical tra	ansformatic	n, Direct
methods in	n variational problems, Ritz	method, Gale	rkin's me	thod, Collecti	on method	and least
square me	thod.					
12. Brief	Description of self-learning	/ E-learning	componei	nt		
1. http:/	//nptel.ac.in/courses/1111040	25/NPTEL-C	oV-IE-Sol	utions.pdf		
2. http://	//nptel.ac.in/courses/1111040/	25/NPTEL-C	oV-IE-Pro	blems.pdf		
3. <u>http:</u>	//www.nptelvideos.in/2012/12	2/calculus-of-	variations	-and-integral.	html	
13. Books	Recommended					
1. A. S	. Gupta: Calculus of Variation	ns with Appli	cations, Pl	HI Learning, 2	2015.	
2. AM	Wazwaz, A First Course in Int	egral Equation	ons (2 nd ec	l.), World Sci	entific, 201	5.
3. R. F	P. Kanwal: Linear Integral H	Equation: The	eory and	Technique (2	ed.), Bi	rkhäuser,
1997	7.					
4. M.D). Raisinghania: Integral Equa	tions and Bo	undary Va	lue Problems,	S Chand &	& Co Ltd,
2016	5.			2		
Nory	white for all'	i.		top	- c.S.	Lalite



1. Name of the De	partment: Mat	hematics				
2. Course Name	Fluid	L		T		P
	Dynamics					
3. Course Code	17030609	3		0		0
4. Type of Course	(use tick	Core ()	DSE ()	AEC ()	SEC (OE ()
mark)					(-)	
5. Pre-requisite		6. Frequency	Even	Odd ()	Either	Every
(if any)		(use tick			Sem ()	Sem ()
Name of the Department: Mathematics Course Name Fluid L T P Dynamics Dynamics O O Course Code 17030609 3 O O Type of Course (use tick Core () DSE () AEC () SEC () OE Pre-requisite 6. Frequency (use tick Even (use tick Odd () Either Even Sem () Sem () Sem () Total Number of Lectures, Tutorials, Practical Even (fany) Odd () Either Even Sem () Odd () Either Even Sem () Sem () <th></th>						
7. Total Number of	of Lectures, Tu	torials, Practica				-
Lectures = 40	·	Tutoria	$\mathbf{IS} = 0$	P	racticals =	0
This course is aime Kinematics (Equat Motion of sphere (dimension), Motion	ed to provide an ion of continuity (Motion in thre n of cylinders.	introduction to the first of th	he theories otion, Gen ources, sin	for fluid dy eral theory ks and dou	rnamics. To of irrotation blets (Moti	pic covers nal motion on in two
). Course Objecti	ives:					
The objective of dynamics in scienc	this course is e and engineerii	to expose stude ng.	nts to und	erstand the	e importanc	e of flui
10. Course Outco	mes (COs):					
 To apply cor fluid flow sys To apply the 	rectly the conse stems with empl general theory c	ervation principle nasis on aerodyna of irrotational mot	es of mass, mics. tion and mo	linear mon	nentum and ere and cyli	l energy t
II. Unit wise deta	$\frac{1100}{1000} = 1$	0 Title of the	unit. Kind	matics (Fo	unition of a	ontinuity
	of lectures – I		unit. Kint	maries (Eq	uation of c	ontinuity
Kinematics, Euleria Velocity potential, Boundary surfaces. Unit – Number 2	an and Lagrangi Irrotational and r of lectures = 1	an methods, Stre l rotational motio 0 Title of the	am lines, p ns, Vortex unit: Equa	ath lines and lines, Equa ations of M	d streak line tion of cont otion	es, inuity,
Acceleration at a p coordinates, Pressu Bernoulli's equation	oint of a fluid , are at a point of n, Impulsive mo	Components of a a moving fluid, otion.	cceleration Euler's and	in cylindrio Lagrange's	cal and sphe s equations	erical pola of motion
Unit – Number 3	r of lectures = 1	0 Title of the Motion	unit: Geno	eral Theory	of Irrotat	ional
Acyclic and cyclic energy theorem, A sphere through a lice	irrotational mo xially symmetr quid at rest at in	tions, Kinetic en ic flows, Liquid finity, Equation c	ergy of irro streaming of motion o	otational flo past a fixed f a sphere.	ow, Kelvin's d sphere, N	s minimu lotion of
Hondy	malik	>	D	c.S. 1	Lelike	



Unit –	Number of lectures =	Title of the unit: Two-Dimensional and Three-
4	10	Dimensional Fluid Flow

Irrotational motion in two-dimension, Complex velocity potential, Milne-Thomson circle theorem, Two dimensional sources, sinks, doublets and their images, Blasius theorem, Two dimensional irrotational motion produced by motion of circular and coaxial cylinders in an infinite mass of liquid. Three dimensional sources, sinks, doublets and their images, Stokes stream function, Property of Stoke's function.

12. Brief Description of self-learning / E-learning component

- 1. https://www.youtube.com/watch?v=lZ7NG16XFGA
- 2. https://www.youtube.com/watch?v=8wM7_vgBSQA
- 3. <u>https://www.youtube.com/watch?v=QeKWOStChiE</u>

13. Books Recommended

- 1. F. Chorlton: Text Book of Fluid Dynamics, CBS Publishers, Delhi, 1985.
- 2. W.H. Besaint and A.S. Ramsey: A Treatise on Hydromechanics, Part II, CBS Publishers, Delhi, 1988.
- 3. R.K. Rathy: An Introduction to Fluid Dynamics, Oxford and IBH Publishing Company, New Delhi, 1976.
- 4. G.K. Batchelor: An Introduction to Fluid Mechanics, Cambridge University Press, 2000.

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1. Name of the De	epartment: Ph	ysics				
2. Course Name	Quantum Mechanics	L		Т		Р
3. Course Code	17030610	4		0		0
4. Type of Course mark)	e (use tick	Core ()	DSE $()$	AEC ()	SEC ()	GE ()
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even $()$	Odd ()	Either Sem ()	Every Sem ()
7. Total Number	of Lectures, T	utorials, Practical				
Lectures $= 52$		Tutorials	= 0	Practical	= 0	
8. Course Descrip	ntion:					

The course will include the Planck quantum concepts of particle and wave natures, atomic models, uncertainty principle, operators, Schrodinger wave equation, and its applications.

9. Course Objectives:

The aim of this course is to understand the quantum mechanical view of particle and wave nature, uncertainty in measurements, certainty and probability in measurements, time-dependent and time-independent Schrodinger wave equations and its solution for the hydrogen atom and many-electron atoms.

10. Course Outcomes (COs):

After completing this course, students will be able to explain the quantum mechanical view of particle and wave nature, uncertainty in measurements, certainty, and probability in measurements, time-dependent and time-independent Schrodinger wave equations, and its solution for the hydrogen atom and many-electron atoms

11. Unit wise detailed content

Unit-1 Number of lectures = 13 Title of the unit: Wave Particle Duality

Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two Slit experiments with electrons. Probability. Wave amplitude and wave functions. Applications of uncertainty principle.

Unit – 2	Number of lectures = 13	Title of the unit: Time-independent and Time-
		dependent Schrodinger equation

Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function, Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions, Normalization, Linearity and Superposition Principles, Eigenvalues and Eigenfunctions, Position, momentum & Energy operators; commutator of position and momentum operators; Expectation values of position and momentum, Wave Function of a Free Particle, Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states.

Unit – 3 Number of lectures = 13 Title of the Unit: General Discussion df Bound States In An Arbitrary Potential

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Continuity of wavefunction, boundary condition, and the emergence of discrete energy levels; application to the one-dimensional problem- square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions,

Quantum theory of hydrogen-like atoms: Time-independent Schrodinger equation in spherical polar coordinates; separation of variables for the second-order partial differential equation; angular momentum operator and quantum numbers; Orbital angular momentum quantum numbers l and m; s, p, d,..shells (idea only).

Unit – 4	Number of lectures = 13	Title of the unit: Atoms in Electric and Magnetic
		Fields

Atoms in Electric and Magnetic Fields: - Electron Angular Momentum, Space Quantization, Electron Spin, and Spin Angular Momentum, Larmor's Theorem, Spin Magnetic Moment, Stern-Gerlach Experiment.

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Atoms in External Magnetic Fields: - Normal and Anomalous Zeeman Effect.

12. Books Recommended

- 1. Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
- 2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn,, 2002, Wiley,
- 3. Quantum Mechanics, Leonard I, Schiff, 3rdEdn, 2010, Tata McGraw Hill,
- 4. Quantum Mechanics, G, Aruldhas, 2ndEdn, 2002, PHI Learning of India,
- 5. Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning,

13. Online Links

1. https://www.youtube.com/watch?v=1az10iSmCzA

2. <u>https://www.youtube.com/watch?v=2ejyr-E7q2M</u>

3. https://nptel.ac.in/courses/115101003/downloads/module2/lecture7.pdf



1. Name of the De	partment: Physic	s					
2. Course Name	Quantum	L		7	Г	H)
	Mechanics Lab					1.50.161.1	
3. Course Code	17030611	0	11	()	4	ŀ
4. Type of Course	(use tick mark)	Core ()	DSE	()	AEC ()	SEC ()	GE ()
5. Pre-requisite		6. Frequency	Even	1	Odd ()	Either	Ever
(if any)		(use tick marks)	(1)		Sem()	Sem()
7. Total Number of	of Lectures, Tuto	rials, Practical		and a			· · · · · ·
Lectures = 0		Tutorials = 0		Pra	ctical = 5	2	
8. Course Descript	tion:			9-1-1			

Experiments include the basic concepts of measurement of Planck's constant using LEDs, measurement of the ionization potential of mercury, work function, hall coefficient etc.

9. Course Objectives:

To understand the working principles of measurement of Planck's constant using LEDs, tunneling current in backward diode or tunnel diode, work function, hall coefficient etc.

10. Course Outcomes (COs):

After performing these experiments, students will be able to implement and demonstrate the photoelectric effect which is how radiation can be converted into electric energy, the effect of the magnetic field to develop potential differences etc.

11. List of Experiments

- 1. To determine the value of Planck's constant using LEDs of at least 4 different colours
- 2. To determine I-V characteristics of PNP transistors
- 3. To study Hall Effect
- 4. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
- 5. Black Body Radiation: Determination of Stefan's Constant
- 6. To study the quantum tunneling effect with solid state device, e.g. tunneling current in backward diode or tunnel diode.
- 7. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.
- 8. To determine the value of the Boltzmann constant using V-I characteristic of PN diode.
- 9. To determine the work function of the filament material of a directly heated vacuum diode.
- 10. To study the emission spectra of Hydrogen, Neon and mercury vapours.

12. Books Recommended:

- 1. Scilab Image Processing: Lambert M. Surhone. 2010Betascript Publishing ISBN: 978-6133459274A
- 2. Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
- 3. Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.

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- 4. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- 6. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

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- 7. https://vlab.amrita.edu/index.php?sub=1&brch=195&sim=359&cnt=1
- 8. https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=548&cnt=4



1.	Name of the De	epartment: Phy	sics				
2.	Course Name	Nuclear and particle physics	L		Т		Р
3.	Course Code	17030612	4		0		0
4.	Type of Course mark)	e (use tick	Core ()	DSE $()$	AEC ()	SEC ()	GE ()
5.	Pre-requisite (if any)		6. Frequen cy (use tick marks)	Even (√)	Odd ()	Either Sem ()	Every Sem ()
7.	Total Number	of Lectures, Tu	torials, Practic	al			- 1

Lectures = 52Tutorials = 0Practical = 08. Course Description:

The syllabus is divided into four units i.e. general properties of nuclei and nuclear models, radioactive decay and nuclear reactions, elementary particles and particle accelerator.

9. Course Objectives:

In this course students will learn about the nuclear structure and its constituent's properties, the phenomenon involve in radioactive decay processes, Nuclear reactions and basics of high energy physics.

10. Course Outcomes (COs):

After the successful completion of the course, students would be able to

- 1. Explain the general properties of nuclei and nucleons.
- 2. Explain the basic physics of radioactivity.
- 3. Explain the various nuclear models, Physics of nuclear reactions and Particle accelerators.
- 4. Describe the basic features involved in Particle Physics.

11. Unit wise detailed content

Unit-1 Number of lectures = 13 Title of the unit: General Properties of Nuclei

Discovery of the nucleus, composition, theories of nuclear composition, Proton-electron theory, failure of Proton-electron theory, Proton-neutron theory basic properties; charge, mass, size, spin, magnetic moment, electric Quadrupole moment, binding energy, binding energy per nucleon and its observed variation with mass number of the nucleus, coulomb energy, volume energy, surface energy, other corrections, explanation of the binding energy curve, liquid drop model of the nucleus.

Unit -2 Number of lectures = 13 Title of the unit: Radioactivity

The radioactive decay law, decay constant and half-life; methods of measurement of half-life, spectra of emitters. Alpha decay: Basic decay process, Geiger-Nuttal law, Gamow's explanation, angular momentum and parity in a decay, energy release in alpha decay. Beta decay: Fermi's theory, angular momentum and parity selection rules, neutrino and antineutrino, non-conservation of parity in beta decay and its experimental verification. Gamma decay: Energetics of a decay, elementary theory of multiple transitions, angular momentum and parity selection rules and parity selection rules, internal conversion, nuclear absorption and fluorescence, Mössbauer effect, energy levels.

Unit-3Number of lectures = 13Title of the unit: Nuclear Models and Nuclear reactionsNuclear Models: Liquid drop model approach, Bethe-Weizsacker formula, applications to semi
empirical mass formula, Fermi gas model of nucleus, evidence for nuclear shell structure, nuclear

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magic numbers, Nuclear shell model, collective model.

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, Direct reactions. Nuclear fusion and fission. Fission and Fusion reactors (Fundamentals) Need for accelerators: Van de Graff, cyclic accelerators, cyclotron, synchrocyclotron, variable energy cyclotron.

Unit-4 Number of lectures = 13 | Title of the unit: Cosmic Rays and Elementary Particles

Discovery of cosmic rays: hard and soft components, discovery of muon, pion, heavy mesons and hyperons, mass and life time determination for muon and pion. Primary Cosmic Rays: Extensive air showers, solar modulation of primary cosmic rays, effect of earth's magnetic field on the cosmic ray trajectories. Classification of elementary Particles, Fundamental interaction, conservation laws, invariance under charge, parity, CP, time and CPT, particles and antiparticles, mesons, Hyperons, resonance states, elementary particle symmetries, Strangeness, conservation of strangeness in particle interactions, quark hypothesis.

12. Books Recommended

- 1. Introductory nuclear Physics by Kenneth S, Krane (Wiley India Pvt, Ltd., 2008), ISBN-978-8126517855
- 2. Concepts of nuclear physics by Bernard L, Cohen, (Tata Mcgraw Hill, 1998), ISBN-9780070992498
- 3. Introduction to the physics of nuclei & particles, R,A, Dunlap, (Thomson Asia, 2004). ISBN- 978-0534392949

4. Introduction to Elementary Particles, D, Griffith, John Wiley & Sons. ISBN- 978-0-471-60386-3

- 5. Quarks and Leptons, F, Halzen and A,D, Martin, Wiley India, New Delhi. ISBN-978-8126516568
- 6. Basic ideas and concepts in Nuclear Physics An Introductory Approach by K, Heyde (IOP-Institute of Physics Publishing, 2004), ISBN-978-0750309806.
- 7. Radiation detection and measurement, G,F, Knoll (John Wiley & Sons, 2000). ISBN: 978-0-470-13148-0
- 8. Theoretical Nuclear Physics, J,M, Blatt &V,F,Weisskopf (Dover Pub,Inc,, 1991).ISBN- 78-1-4612-9961-5

13. Online links

1.https://nptel.ac.in/courses/115102017/2

2.

https://www.youtube.com/watch?v=iMhDYarsfII&rel=1&color1=0xcbba9f&color2=0xcbba9f&bo rder=0&fs=1

3. https://home.cern/science/accelerators

4.

http://oregonstate.edu/instruct/ch374/ch418518/Chapter%2017%20Interaction%20of%20Radiation %20with%20Matter-rev.pdf

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Particle Physics Laboratory - 3. Course Code 17030613 0 0 4. Type of Course (use tick mark) Core () DSE ($$) AEC () SEC () GE () 5. Pre-requisite (if any) 6. Frequency (use tick marks) Even () Odd ($$) Either Sem () Sem () 7. Total Number of Lectures, Tutorials, Practical Lectures Practical = 52 8. Course Description: In this course student will hand on the experiments using weak radioactive sources, G.M counters, Scintillation Counters, MCA, SCA, DAC and CRO. 9. Course Objectives: The course aims to provide students with a practical knowledge of the radiation measurem basic electronics behind nuclear techniques and radiation detectors. 10. Course Outcomes (COs): After performing these experiments, students will be able to 1. Demonstrate experiments involving Nuclear phenomenon. 2. Develop their hand on sophisticated experimental set ups in lab. 3. Understand the basic methods followed in research. 4. Work with radiation detection systems. 11. List of Experiments 1. To determine the plank's constant using stopping potential measurements. 2. To determine to graving voltage. 4. Measurement of dead time. 5. To investigate the statistics related to measurements with a Geiger count	2. Course Name	Nuclear and	L	Т		Р	
Physics Laboratory Physics Laboratory 3. Course Code 17030613 0 0 4 4. Type of Course (use tick mark) Core () DSE (\sqrt{)} AEC () SEC () GE () 5. Pre-requisite (if any) 6. Frequency (use tick marks) Even () Odd (\sqrt{)} Either Sem () Sem () 7. Total Number of Lectures, Tutorials, Practical Even () Odd (\sqrt{)} Either Sem () Sem () 8. Course Description: In this course student will hand on the experiments using weak radioactive sources, G.M counters, Scintillation Counters, MCA, SCA, DAC and CRO. 9. 9. Course Objectives: The course aims to provide students with a practical knowledge of the radiation measurem basic electronics behind nuclear techniques and radiation detectors. 10. 10. Course Outcomes (COS): After performing these experiments, students will be able to 1. Demonstrate experiments involving Nuclear phenomenon. 2. 2. Develop their hand on sophisticated experimental set ups in lab. 3. 11. 3. Understand the basic methods followed in research. 4. Work with radiation detection systems. 11. List of Experiments Indetermine the plank's constant using stopping potential measurements. 1.		Particle	~	1		1	
Laboratory43. Course Code170306130044. Type of Course (use tickCore ()DSE ($$)AEC ()SEC ()GE ()5. Pre-requisite6. FrequencyEven ()Odd ($$)EitherEven ()7. Total Number of Lectures, Tutorials, PracticalEatherSem ()Sem ()LecturesTutorials, PracticalLecturesTutorials, PracticalLecturesTutorials, PracticalLecturesSem ()Odd ($$)EitherSem ()Sem ()Sem ()Odd ($$)Sem ()Sem ()Sem ()Sem ()Notation Counters, MCA, SCA, DAC and CRO.9. Course Objectives:The course aims to provide students with a practical knowledge of the radiation measurembasic electronics behind nuclear techniques and radiation detectors.10. Course Outcomes (COs):After performing these experiments, students will be able to1. Demonstrate experiments involving Nuclear phenomenon.2. Develop their hand on sophisticated experimental set ups in lab.3. Understand the basic methods followed in research.4. Work with radiation detection systems.11. List of Experiments1. To determine the plank's constant using stopping potential measurements.2. To determine the statistics related to measurements with a Geiger counter. <th></th> <th>Physics</th> <th></th> <th>1.2</th> <th></th> <th>1. 1. 1.</th> <th></th>		Physics		1.2		1. 1. 1.	
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 Measurement of Short Half-life. To determine the absorption of gamma rays using absorption coefficients using simulation. Books Recommended: Techniques in Nuclear and particle Experiments by W.R. Leo (Springer), 1994. ISBN-978-3540572800 Radiation detection and measurement by Glenn F. Knoll (Wiley), 2010. ISBN: 978-0-470-13148-0 Introduction to Experimental Restrict Plancia de Plancia de Plancia. 	. Source strength	of a Beta Source	e.				
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 Books Recommended: Techniques in Nuclear and particle Experiments by W.R. Leo (Springer), 1994. ISBN- 978-3540572800 Radiation detection and measurement by Glenn F. Knoll (Wiley), 2010. ISBN: 978-0- 470-13148-0 Introduction to Experimental Restricts Physics in the Print of Figure 10. 	simulation.			1			
 1 echniques in Nuclear and particle Experiments by W.R. Leo (Springer), 1994. ISBN- 978-3540572800 2. Radiation detection and measurement by Glenn F. Knoll (Wiley), 2010. ISBN: 978-0- 470-13148-0 4. Introduction to Experimental Restricts Plancing to Experimental Plancing to Experimenta Plancing to Experimental Plancing to Exp	2. Books Recomm	nended:					
. Radiation detection and measurement by Glenn F. Knoll (Wiley), 2010. ISBN: 978-0-470-13148-0	. Techniques in N 978-3540572800	uclear and parti)	cle Experiments	by W.R. Le	eo (Spring	er), 1994.	ISBN-
Introduction to Experimental Destin DI ' I D'I IT	Radiation detecti 470-13148-0	on and measure	ment by Glenn	F. Knoll (W	viley), 2010	0. ISBN: 9	978-0-
Press), 2001. ISBN-978-0511622588	. Introduction to E Press), 2001. ISE	xperimental Pa 3N-978-051162	rticle Physics by 2588	Richard Fe	ernow (Car	mbridge U	niversity



2. Course Na 3. Course Co	ne De	epartment: Phy	SICS					
3. Course Co	ame	Astrophysics	L			Т		Р
A Type of C	Course Code 17030614		4		0		0	
Type of C	ourse	e (use tick	Core ()	DSH	E (√)	AEC ()	SEC ()	GE ()
mark)	Cha						-	
5. Pre- requisite	That	sical Mechanics	S, 0. F	requency	Even	Odd	Either	Every
(if any)	I nel	interview of the second s		arks)			Sem ()	Sem ()
(Stati	Istical Mechanic	s, "		1			
	Qua	ntum Mechanic	s,		1.1			
	Basi	c understanding	, of					
7	Opti	.cs.						
/. I otal	Num 52	ber of Lectures	, Tutorial	s, Practical		Deret	1 0	
8. Cours	52 e Des	scription.	1 utorial	$\mathbf{s} = 0$		Practica	$\mathbf{u} = 0$	· · ·
	e Des	di i			-			
Students com	pletin	g this course wi	ll gain an u	inderstandi	ng of:			
Theoretical ba	isis fo	or our modern co	osmologica	l view of th	e unive	rse, incluc	ling the be	ginning at
Big Bang an	nd th	e development	up to e	arly galax	y form	ation, As	tronomica	l objects,
Astronomical	coord	linate system, C	omponent	of solar sys	tem and	its evolu	tion, Comp	ponents of
on experiment	and It	the latest obser	e large-scal	e structure	of the l	Universe a	nd its histo	ory, hands
into the curren	it issu	les.	vational res	with within	cosmol	ogical res	earch, and	an insight
0			<u>.</u>					
7. Cours	e Ob	jectives:	a students	····· 41 1		1-1	1	
nins course is	s desi	igned to provid	e students	with the l	basic kr	nowledge	about astr	ophysical
Silenomena al	iu cos	mology.						
10. Cours	e Out	tcomes (COs):						
1. Theoretica	il bacl	kground to mod	ern cosmol	ogy and the	e most c	ommon m	isconcepti	ons about
the Big Ba	ing m	odel.						
2. Calculatio	ns co	ncerning cosmo	ological dis	tances, cos	mic dyi	namics, th	e energy c	content of
3 Learn and	se, co	sinc backgroun	f research		unt for	como aubi	field of ear	
4. Analyze o	observ	ational data re	levant for	modern co	smolog	v and for	mulate co	nclusions
based on t	hese.	unonur unu ro	ievunt ioi	modern et	Smolog	y and for	mulate co	nerusions
5. propose st	rategi	ies for observat	ions and t	heoretical r	nodels	that may	lead to ne	w insight
about unso	olved	problems in cos	mology, po	ossible to w	ork at C	CCSP, SG	T Universi	ty.
1. Unit w	vise du	etailed content						
Unit-1	150 4	Number of lect	ures = 13	Title of t	the unit	: Introdu	ction to	
				Astrono	my			
			0.1 2111					
HICTORY OF OCT	ronon	hy, Overview of	f the Nigh	t Sky, Astr	onomic	al Objects	and their	physical
tructures Lig	in and	asic concents of	f Positiona	1 Astronom	s, Teles	scopes: Op	otical, Rad	io and X-
tructures, Lig	es Ba			1 ASHOHOH	iy. Cen	Justian Spin	ere, Geom	letty of a
tructures, Lig Ray Telescope Sphere, Spher	es, Ba ical T	riangle. Astron	omical Co	ordinate S	vstems	Horizon	System F	auatorial
structures, Lig Ray Telescope Sphere, Spher System, Conve	es, Ba ical T ersion	Triangle, Astron of Coordinates.	omical Co Rising and	ordinate S d Setting Ti	ystems, mes, M	easuremer	System, E at of Time	Equatorial Side real
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structures, Lig Ray Telescope Sphere, Spher System, Conve Fime, Apparer LMT, UT, UT	es, Ba ical 7 rsion it Sola C). D	Friangle, Astror of Coordinates, ar Time, Mean S Diurnal and Year	omical Co Rising and Solar Time rly motions	oordinate S I Setting Ti Equation of the Sun	ystems, mes, Mo of Time , Stars a	Astronor and Conste	System, E at of Time, nical Time ellations.	Equatorial Side real Systems
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Structures, Lig Ray Telescop Sphere, Spher System, Conve Fime, Apparer LMT, UT, UT	es, Ba ical T ersion it Sola (C). D	Friangle, Astror of Coordinates, ar Time, Mean S Diurnal and Year Number of lect	iomical Co Rising and Solar Time rly motions ures = 13	ordinate S d Setting Ti , Equation of s of the Sun Title of t	ystems, mes, Mo of Time , Stars a he unit	Astronor and Conste : Astrono	System, E nt of Time, nical Time ellations. mical obj	Equatorial Side real Systems ects
Structures, Lig Ray Telescop Sphere, Spher System, Conve Time, Apparer LMT, UT, UT	es, Ba ical T ersion it Sola IC). D	Friangle, Astror of Coordinates, ar Time, Mean S Diurnal and Yea Number of lect	iomical Co Rising and Solar Time rly motions ures = 13	ordinate S d Setting Ti , Equation of s of the Sun Title of t	ystems, mes, M of Time , Stars a he unit	Astronor and Consta : Astrono	System, E nt of Time, nical Time ellations. mical obj o	Equatorial Side real Systems ects





Star, Star formation, Spectra and Classification, Stellar Structure Equations and Survey of Stellar Evolution, Stellar Oscillations, Degenerate and Collapsed Stars, Radio Pulsars, Interacting Binary Systems, Blackholes, Accretion Disks, X-ray Sources, Interstellar Medium: HII Regions, Supernova Remnants, Molecular Clouds, Dust, Radiative Transfer, Jeans' Mass.

Unit – 3	Number of lectures = 13	Title of the unit: Sun and the Milky Way					

Galactic Stellar Distributions and Populations: Oort Constants, Oort Limit, Globular Clusters. Solar Parameters, Sun's Internal Structure, Solar Photosphere, Corona, Solar Activity, Solar Magneto-Hydrodynamics, Basic Structure and Properties of the Milky Way.

Unit – 4	Number of lectures = 10	Title of the unit: Cosmology				

Cosmic Distance Ladder, Olbers Paradox, Cosmological principle. The expansion of the universe and Hubble's Law, Newtonian Cosmology, Freidman evolution equations. Hot bigbang model, Radiation and matter dominated universe, Age of Universe, origin of Cosmic Microwave Background, Dark matter, Dark Energy.

12. Books Recommended

1. Fundamental of Astronomy (Fourth Edition), H. Karttunen et al. Springer

2. Astrophysics Stars and Galaxies K D Abhyankar, Universities Press

3. Modern Astrophysics, B.W. Carroll & D.A. Ostlie, Addison-Wesley Publishing Co.

4. BaidyanathBasu, An introduction to Astrophysics, Second printing, Prentice - Hall of India Private limited, New Delhi, 2001.

5. Introductory Astronomy and Astrophysics, M. Zeilik and S.A. Gregory, 4th Edition, Saunders College

6. Hansen, Carl J., Steven D. Kawaler, and Virginia Trimble. *Stellar Interiors: Physical Principles, Structure and Evolution*. New York, NY: Springer, 2004.

7. Carroll, Bradley W., and Dale A. Ostlie. *An Introduction to Modern Astrophysics*. Reading, MA: Addison-Wesley Pub., 1995.

8. Kippenhahn, Rudolf, and Alfred Weigert. *Stellar Structure and Evolution*. New York, NY: Springer-Verlag, 1990.

9. Shapiro, Stuart L., and Saul A. Teukolsky. *Black Holes, White Dwarfs, and Neutron Stars*. New York, NY: Wiley

dent put 2000

13. Online Links:

https://egyankosh.ac.in/bitstream/123456789/19450/1/Unit-1.pdf

https://ocw.mit.edu/courses/8-901-astrophysics-i-spring-2006/pages/syllabus/

https://www.britannica.com/science/astronomy/The-techniques-of-astronomy



1.	Name of the Dep	partment: Physics					
2.	Course Name Astrophysics Lab		L		Т	Р	
3.	Course Code	17030615	0	Andre St.	0		4
4.	Type of Course	e of Course (use tick mark)		DSE	AEC	SEC	GE ()
				(\mathbf{v})	0	0	, v
5.	Pre-requisite		6. Frequency	Even	Odd	Either	Every
	(if any)		(use tick	(1)	0	Sem	Sem ()
			marks)			0	
7.	Total Number o	f Lectures, Tutorial	ls, Practical				
	I a stress 0						

Lectures = 0 Tutorials = 0 Practical = 52

8. Course Description:

This course is designed to provide students with the basic knowledge about astrophysical phenomena and cosmology

9. Course Objectives:

This course is designed to provide students with the basic knowledge about astrophysical phenomena and cosmology

10. Course Outcomes (COs):

1. Sun is the constant source of energy to our planet Earth. This energy comes to us in the form of sun light. This experiment will help us to measure the quantity of solar energy that comes to Earth.

2. The students will determine a value for Hubble's constant, based on the observations of the images and spectra of 10 spiral galaxies.

3. the age of the Universe

4. Students will calculate and plot the galaxy rotation curve from observational data from any spiral galaxy data from the data catalogue of experiment 2 and will compare it with the curve predicted by the gravitational theory applied only to the visible matter of the galaxy.

5. The students will use star data catalogue to construct H-R diagram.

11. List of Experiments

- 1.Calculation of Solar constant
- 2. Hubble's Law
- 3. Age of the Universe
- 4. Galaxy Rotation Curve
- 5. The Hertzsprung-Russell diagram(H-R diagram)
- 6.Comeelin between Galaxies and their central black hole
- 7. Ring of stars
- 8. Blackbody radiation

9. RGB analysis

12. Books Recommended:

- 1. Fundamental of Astronomy (Fourth Edition), H. Karttunen et al. Springer
- 2. Astrophysics Stars and Galaxies K D Abhyankar, Universities Press

3. Modern Astrophysics, B.W. Carroll & D.A. Ostlie, Addison-Wesley Publishing Co.

pere plue



4. BaidyanathBasu, An introduction to Astrophysics, Second printing, Prentice - Hall of India Private limited, New Delhi, 2001.

5. Introductory Astronomy and Astrophysics, M. Zeilik and S.A. Gregory, 4th Edition, Saunders College

6. Hansen, Carl J., Steven D. Kawaler, and Virginia Trimble. *Stellar Interiors: Physical Principles, Structure and Evolution*. New York, NY: Springer, 2004.

7. Carroll, Bradley W., and Dale A. Ostlie. An Introduction to Modern Astrophysics. Reading, MA: Addison-Wesley Pub., 1995.

8. Kippenhahn, Rudolf, and Alfred Weigert. Stellar Structure and Evolution. New York, NY: Springer-Verlag, 1990.

9. Shapiro, Stuart L., and Saul A. Teukolsky. *Black Holes, White Dwarfs, and Neutron Stars.* New York, NY: Wiley

13. Online Links

https://egyankosh.ac.in/bitstream/123456789/19450/1/Unit-1.pdf

https://ocw.mit.edu/courses/8-901-astrophysics-i-spring-2006/pages/syllabus/

https://www.britannica.com/science/astronomy/The-techniques-of-astronomy

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1 N 60	D			· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·					
1. Name of the Department: Chemistry										
2. Course Nam	e Polyme	r Chemistry	L	Т		Р				
3. Course Code	Course Code 17030616		4	0		0				
4. Type of Course (use tick mark)		Core ()	DSE (✔)	AEC ()	SEC ()	GE ()				
5. Pre-requisit	e NA		6. Frequency	Even (✔)	Odd ()	Either	Every			
(if any)		Sector as a sector	(use tick marks)			Sem ()	Sem ()			
7. Total Numb	7. Total Number of Lectures, Tutorials, Practicals									
$\frac{\text{Lectures} = 52}{\text{Constrained}} \qquad \qquad \text{Tutorials} = 0 \qquad \qquad \text{Practical} = 0$										
8. Course Description										
The course introduces polymer chemistry, its classification, Functionality and its importance. Kinetics and										
mechanism of Polymerization, Crystallization and crystallinity, Nature and structure of polymers, Molecular										
weight distribut	ion in polyme	rs, Glass transit	ion temperature and	determination	n of Tg, Pc	olymer Sol	ution and			
properties of the	e polymers.	the second second second				. (
9. Course Obj	ectives	a la companya da companya d								
The objectives	of this course a	are to:								
1. To study the	e fundamental	concepts of po	lymer chemistry.							
2. To study the	e structure of i	monomers, fund	ctionality, classificat	ion and nome	enclature o	f polymers	3.			
3. To evaluate	the effect of f	actors such as j	polymer structure, m	olecular weig	ght, branch	ing and di	luents on			
4 To study the	·	ada af naluman	ization reactions the	:	1.1					
4. To study the	tions	ous of polymer	ization reactions, the	ir mechanism	i, kinetics,	structure p	roperties			
10 Course Out	tions.						-			
Linon successfu	l completion c	f this course th	a student will be ab	la tat	<u></u>		-			
1 Understand	the basic con	or uns course, u	r chamistry and diffe	le lo:	ofnolum	anizationa	and that			
kinetics	the basic con	cept of polyme	i chemisuy and unite	fent methods	s of polym	erizations	and their			
2 Develop sk	ills for synthe	sizing polymeri	ic products and unde	erstand their a	hysical ar	d thermos	lynamics			
properties.	ins for synthe.	sizing polymen	te products and ande	istand then j	Jily Stear al		iynannes			
3. Demonstrat	e an ability to	acquire knowle	edge in new polymer	-related appli	cations qu	ickly.				
4. Develop spo	ecific skills, co	ompetencies, ar	nd thought processes	sufficient to	support fu	rther study	or work			
in the field of P	olymer Chemi	stry.	0 1		11					
11. Unit wise d	etailed conter	nt			Constanting of the		1000			
Unit-1	Number of le	ectures = 10	Title of the uni	t: Introduc	tion and	Function	ality of			
			polymeric materia	als						
Classification o	f polymers, P	olymer nomen	clature, Molecular f	orces and ch	emical bo	nding in p	olymers,			
Texture of poly	ners. Nature a	nd structure of	polymers-Structure F	roperty relati	onships. C	riteria for	synthetic			
polymer format	ion, classifica	tion of polyme	rization processes, R	elationships	between f	unctionalit	y, extent			
of reaction and	degree of poly	merization. Bi-	functional systems,	Poly-function	al systems	3.				
Unit-2	Number of le	ectures = 14	Title of the un Crystallinity	it: Kinetic	s of Pol	ymerizati	on and			
Mechanism and	Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and									
coordination polymerizations, mechanism and kinetics of copolymerization, polymerization techniques.										
Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers,										
Factors affecting crystalline melting point.										
Unit-3 Number of lectures = 14 Title of the unit: Molecular weight, Glass transition										
temperature (Tg) and determination of Tg, Polymer Solution										
Determination of molecular weight of polymers (Mn, Mw, etc) by end group analysis, viscometry, light										
scattering and osmotic pressure methods. Molecular weight distribution and its significance.										
Polydispersity in	Polydispersity index. Glass transition temperature (Tg) and determination of Tg: Free volume theory, WLF									
equation, Factors affecting glass transition temperature (Tg). Criteria for polymer solubility, Solubility										
parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of										
polymers solution	polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.									

1 10 to a fet


Unit-4	Number of lectures = 14	Title of the unit: Properties of Polymers
Properties of Pol	ymers (Physical, thermal, flow &	& mechanical properties). Brief introduction to preparation,
structure, proper	ties and application of the fo	ollowing polymers: polyolefins, polystyrene and styrene
copolymers, poly	y(vinylchloride) and related po	lymers, poly(vinyl acetate) and related polymers, acrylic
polymers, fluoro	polymers, polyamides and re	elated polymers. Phenol formaldehyde resins (Bakelite,
Novalac), polyu	rethanes, silicone polymers, p	polydienes, Polycarbonates. Introduction to Conducting
Polymers, [polya	cetylene, polyaniline, poly(p-ph	enylenesulphide polypyrrole, polythiophene)].
12. Brief Descri	ption of self-learning/ E-learni	ng component
1. http://www.n	nalcolmmackley.com/polymers/	lecture-notes/
https://egyan	kosh.ac.in/bitstream/123456789	/29632/1/Unit-7.pdf
2. https://nptel.a	ac.in/courses/104105039	
3. Web.mit.edu	/5.33/www/lec/poly.pdf	
4. https://ocw.n	nit.edu/courses/3-064-polymer-e	engineering-fall-2003/pages/lecture-notes/
13. Books Recor	nmended	
1 0 1	OFIC LIPI OF	

- 1. Carraher, C.E. Jr Carraher's Polymer Chemistry, 4th Ed. CRC Press, 2017. ISBN: 9781498737494
- 2. Odian, G. Principles of Polymerization, 4th Ed. Wiley, 2004. ISBN: 9780471274001
- 3. Billmeyer, F.W. Textbook of Polymer Science, 2nd Ed. Wiley Interscience, 1994. ISBN:978-0471031963
- 4. Ghosh, P. Polymer Science and Technology: Plastics, Rubbers, Blends and Composites, Tata McGraw-Hill Education, 2001. ISBN: 0074639943
- 5. Fried J.R, Polymer Science & Technology, Prentice Hall (2005), ISBN: 013685561X
- 6. Feldman D., Barbalata. A, Synthetic Polymers: Technology, Properties, Applications. Springer Science & Business Media, 1996. ISBN: 0412710404



1. Name of the Departm	ment: Chemistry		-					103	
2. Course Name	Polymer Chemistry I	Lab	L			Т			Р
3. Course Code	17030617		0	1.4.1		0			4
4. Type of Course (use	tick mark)	Core	e ()	DS		AEC ()	SEC	0	GE ()
5. Pre-requisite	NA	6. Fr	equency	Ev	$en(\mathbf{J})$	Odd ()	Eithe	er	Every
(if any)		(use	tick marks)	2.	cii (•)		Sem	0	Sem ()
7. Total Number of Lee	ctures, Tutorials, Pra	acticals		QVs 1				· ·	V
Lectures = 0		Tutor	ials = 0		Practi	cal = 52 h	rs.		
8. Course Description				1.11					
Experiments in this class	s are broadly aimed at	acquai	nting students	with	the ran	ge of prop	erties of	ofpo	olymers,
methods of synthesis, pu	irification and characte	erizatio	n including ins	strur	nental te	chniques.	Some	exa	nples of
laboratory work includ	e solution polymeriz	ation of	of styrene (St), II	nterfacia	l polymer	rizatio	n: p	olyester
preparation, Redox p	olymerization of a	crylami	ide, Precipita	tion	polym	erization	of a	acryl	onitrile,
Determination of molecu	ular weight by viscom	etry, ar	nd testing of m	echa	inical pr	operties of	polyn	ners	•
9. Course Objectives								-	
The objectives of this co	ourse are to:								
 To gain the basic kin To develop synthetic 	owledge of polymer's	ynthesi	S	ofn	lumana				
3 To study the method	ts of measuring the mo	and ch	weight polyn	or p	ation ki	netics and	co nol	luma	rization
and polymer processing	technologies	Jicculai	weight, polyn		ation Ki	lieues anu	co-poi	lynne	allon
10. Course Outcomes (COs)			1.10					
Upon successful comple	tion of this course, the	e studer	nt will be able	to:					
1. Master the basic exp	perimental skills for th	e synth	esis of polyme	rs v	ia variou	is polymer	izatio	n tec	hniques
2. Develop specific ski	ills about the mechanic	cal prop	perties and app	lica	tions of	polymers.			1
3. Develop the ability t	o design a hypothesis	driven	research proje	ct ar	d design	n and exec	ute ex	perin	ments to
evaluate the stated hypot	thesis.								
11. List of Experiments	s: (Student has to per	form t	en experimen	ts)					
1. Free radical solution	n polymerization of st	tyrene	(St) / Methyl 1	Metl	nacrylate	e (MMA)	/ Meth	nyl /	Acrylate
(MA) Acrylic acid (A	AA).								
a. Purification of n	nonomer	(DDC							
b. Polymerization	using benzoyl peroxid	e (BPC)/2,2°-azo-bi	SISO	butyloni	trile (AIB)	N)		
2. Preparation of nyion	10,0								
 Redox polymerization Dresinitation of here 	on of acrylamide								
4. Precipitation polyme	formation of acrylonitri	le							
5. Preparation of urea-	formaldenyde resin								
 Preparations of nova Determinediate 	liac resin/resold resin.								
7. Determination of mo	olecular weight by vise	cometry	y:						
h (Poly vinyl prop	aq. NanO ₂ solution	ar							
8 Determination of the	viscosity-average mo	lecular	weight of poly	(vii	w alcok	al) (PVO)	L) and	the	fraction
of "head-to-head" m	onomer linkages in th	e nolvr	ner	y(vii	iyi alcoi		n) and	ule	fraction
9. Determination of m	olecular weight by en	d grour	analysis. Poly	reth	lene al	Col (PEG) (OH	aroi	(n)
10 Determination of hy	vdroxyl number of a n	olymer	using colorim	etric	method)(011	grou	.
11. Estimation of the ar	nount of HCHO in the	e given	solution by so	diur	n sulnhit	e method			
12 Preparation of poly	acrylamide and its elec	ctropho	resis	urun	i suipini	e methou.			
13 Synthesis of polyan	iline	cuopiio	10515						
12. Brief Description of	f self-learning/ E – le	arning	component	1000					
1. http://www.egvanko	sh.ac.in/bitstream/123	456789	9/15899/1/Exp	erin	ent-13	odf			
2. https://ocw.mit.edu/o	courses/chemical-engi	ineering	z/10-569-synth	esis	-of-polv	mers-fall-	2006/1	ectu	re-
notes/lec16_101820	06.pdf				rJ				
13. Books Recommende	ed			•	1.				
M	A B	pto-	-		Ah	z.		7	



- M.P. Stevens, Polymer Chemistry: An Introduction, 3rd Ed., Oxford University Press, 1998, ISBN: 9780195124446
- H.R. Allcock, F.W. Lampe & J.E. Mark, Contemporary Polymer Chemistry, 3rd ed. Prentice-Hall (2003), ISBN: 0130650560
- 3. Fried J.R, Polymer Science & Technology, Prentice Hall (2005), ISBN: 013685561X
- 4. P. Munk & T.M. Aminabhavi, Introduction to Macromolecular Science, 2nd ed. John Wiley & Sons (2002), ISBN: 9780471417163
- 5. L. H. Sperling, Introduction to Physical Polymer Science, 4th ed. John Wiley & Sons (2005), ISBN: 9780471757115
- 6. M.P. Stevens, Polymer Chemistry: An Introduction 3rd ed. Oxford University Press (1999). ISBN: 9780195124446
- 7. Carraher, C.E. Jr Carraher's Polymer Chemistry, 4th Ed. CRC Press, (2017). ISBN: 9781498737494



1 Name of the	Department: Chamistry					
2. Course Name	Organometallics Bioing	rganic Chemistry	I	Т	1)
a. Course Maine	Polynuclear Hydrocarbo	ons and LIV IR	L	1	1	
	Spectroscopy	ins and ov, it				
3. Course Code	17030618		4	0	()
4. Type of Cours	se (use tick mark)	Core ()	DSE ()	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even (Odd ()	Either	Every
(if any)		(use tick marks)		ouu ()	Sem ()	Sem ()
7. Total Number	r of Lectures, Tutorials, Prac	ctical				
Lectures = 52		Tutorials = 0	Pra	ctical = 0		
8. Course Descr	iption					
To introduce stud	dents the chemistry of 3d met	als. They will learn	about Organ	nometallic	Compoun	ds, Bio-
Inorganic Chemi	stry, which are frontier areas of	of Chemistry. The le	arners are in	troduced t	to Polynuc	lear and
heteronuclear an	omatic compounds, Active	methylene compo	unds. The	students	will learn	n about
Spectroscopy, wh	nich is an important analytical	tool for identificatio	on of organic	compoun	ds.	
9. Course Object	ctives					
The objectives of	this course are to:					
1. Introduce the	e knowledge of organic and in	lorganic chemistry				
2. To know the	basic chemistry of different c	a alugidation of yor	metals	loon hoto		mamatia
compounds	but basic concepts on structur	e elucidation of van	ious polynuc	lear, neter	onuclear a	tromatic
4 To gain has	ic knowledge about spectroso	conic techniques and	d their usag	e in struct	ure elucid	ation of
known com	bounds.	copie teeninques un	a men usag	e m suuei	ure cruera	ation of
10. Course Outc	omes (COs)					
Upon successful	completion of this course, the	student will be able	to:			<u> </u>
1. Applications	of organometallics, bio inorga	nic chemistry in from	ntier areas of	f Chemistr	y	
2. Understand t	he basic concepts on structure	e elucidation of vari	ous polynuc	lear, heter	onuclear a	aromatic
compounds a	nd their important reactions.					
3. Use basic pr	inciples of UV-visible and	IR spectroscopy for	qualitative	organic a	nalysis of	known
compounds.						
4. Understand a	and demonstrate how the stru	cture of biomolecul	es determine	es their ch	emical pro	operties,
11 Unit wise det	a biological uses.					
Unit_1	Number of lectures $= 14$	Title of the unit:	Chamistry	of 3d mot	ale and	
Unit-1	intumber of rectures – 14	Organometallic	Compounds	or Su meta	ais anu	
Oxidation states	displayed by Cr. Fe. Co. Ni	and Co. A study	of the follow	wing com	pounds (ir	cluding
preparation and i	important properties); Peroxo	compounds of Cr.	$K_2Cr_2O_7$. Kl	MnO ₄ , K ₄	Fe(CN) ₆].	sodium
nitroprusside, [Co	$(NH_3)_6$ [Cl ₃ , Na ₃ [Co(NO ₂) ₆].	1			()0];	
Definition and C	lassification with appropriate	examples based on	nature of m	etal-carbon	n bond (io	nic, s, p
and multicentre	bonds). Structures of methyl	lithium, Zeise salt	and ferroce	ne. EAN	rule as ap	plied to
carbonyls. Prepar	ration, structure, bonding and	properties of monor	nuclear and	polynuclea	ar carbony	ls of 3d
metals. pi-accept	or behaviour of carbon monox	ide. Synergic effects	s -VB approa	ich.		
Unit-2	Number of lectures = 12	Title of the unit:	Bio-Inorga	nic Chemi	stry	
A brief introducti	on to bio-inorganic chemistry.	Role of metal ions p	present in bio	ological sy	stems with	special
reference to Na',	K and Mg ² ions: Na/K pump	; Role of Ca ²⁺ in blo	od clotting,	Metalloen	zymes:chlo	orophyll
Unit 3	Number of lectures = 12	Title of the series	Delanala	TT-4		
Unit-3	Number of fectures $= 12$	Compounds and	Polynuclea	r, Heteroi	nuclear A	romatic
Properties of the	following compounds with	reference to elect	trophilic on	d nucleon	hilio cubo	titution
Naphthalene Ant	thracene Furan Pyrrole Thio	nhene and Pyridine	dopinite and	u nucleop	mile subs	intution.
Preparation: Clais	sen ester condensation. Keto-e	nol tautomerism.				
Reactions: Synthe	etic uses of ethylacetoacetate (preparation of non-h	neteromolecu	les having	g upto 6 ca	rbon).
Unit-4	Number of lectures = 14	Title of the unit:	Application	of Spectr	oscopy to	Simple
		Organic Molecul	es	1	1.	
11			Ν.			
VA		Ata	- A	h.		
		JR	to	1		
X			1			



Electromagnetic radiations, electronic transitions, $\lambda max \& \epsilon max$, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating λmax of conjugated dienes and α,β – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions). Application of visible, ultraviolet and Infrared spectroscopy in organic molecules.

12. Brief Description of self-learning/ E - learning component

- 1. https://nptel.ac.in/courses/104101006
- 2. web.uvic.ca/~mcindoe/423/423syllabus.html
- 3. https://nptel.ac.in/courses/104108062
- 4. https://www.youtube.com/watch?v=uMaKBybnfrk
- 5. https://nptel.ac.in/courses/102103044/3

13. Books Recommended

- 1. Lee J.D. A New Concise Inorganic Chemistry, Oxford University Press; 5th Ed. (2008) ISBN:978-8126515547.
- Cotton F.A. & Wilkinson G. Basic Inorganic Chemistry, John Wiley & Sons; (1995), ISBN: 978-0471505327.
- 3. Finar I.L. Organic Chemistry, Volume 1, 6th Ed. Pearson (2012) ISBN: 9788177585421
- 4. Silverstein R.M., Bassler G.C. & Morrill T.C. Spectrometric identification of organic compounds, 6th Ed., John Wiley & Sons. (2006), ISBN: 9788126509720.
- 5. Morrison R.T., Boyd, R.N. Organic Chemistry, 6th Ed. Prentice Hall. (1992) ISBN: 9780136436690.



2. Course Mame	Organometallics, Bio	inorganic Chemistry,	L	Τ	1	2
	Spectroscopy Lab	I DOIIS and UV, IK	1	chier and		
3 Course Code	17030619		0	0		1
4. Type of Course	(use tick mark)	Core ()		AECO	SECO	GE
Pre-requisite	NA	6 Frequency		Odd ()	Either	Ever
if any)		(use tick marks)			Sem ()	Sem
7. Total Number of	of Lectures, Tutorials.	Practical				1 Sem
Lectures = 0		Tutorials = 0	Prac	tical $= 52$	hrs.	and the second
8. Course Descrip	tion					
This course provide	es students with practic	al experience of the techn	iques used in	n basic ino	rganic and	lorgani
chemistry. Some	examples of the expe	eriment are Separation of	of mixtures	by paper	chromate	ography
Preparation of the c	omplexes and measure	ment of their conductivity.	, Qualitative	Organic A	nalysis of	Organ
Compounds.			1			-
. Course Objecti	ives					
The objectives of the	his course are to:					
. To identify the	unknown organic com	pounds.				
. To develop qu	ualitative technique sk	cills in students includin	g preparatio	on of the	metal con	nplexe
hromatographic se	eparation.					
. Prepare and pu	rify complexes and cor	npare their conductances	with those o	f standard	solutions	
0. Course Outcon	mes (COs)					2
Jpon successful co	mpletion of this course	e, the student will be able	to:			
. Understand the	oretical principle of ch	romatography and separat	te and identit	fy cations	of analytic	al grou
and II with the he	lp of paper chromatogr	aphy				-
2. Describe the s	teps involved in the id	dentification organic com	pounds by	classical o	qualitative	organ
inalysis					•	č
3. Describe the fu	inctional group tests an	d methods of the preparat	ion of deriva	atives		
1. List of Experim	ments: (Student has to	perform any ten experi	iments)			
I. Separation of n	nixtures by chromatogr	aphy: Measure the Rf valu	ie in each ca	se. (Comb	ination of	two ior
to be given)						
a. Paper chro	matographic separation	n of Fe^{3+} , A1 ³⁺ and Cr ³⁺ or				
b. Paper chro	matographic separation	n of Ni ²⁺ , Co ²⁺ , Mn ²⁺ and Z	Zn^{2+}			
2. Preparation of	any two of the followir	ng complexes and measure	ement of the	ir conduct	ivity:	
a. tetraammir	necarbonatocobalt (III)	nitrate				
b. tetraammir	necopper (II) sulphate					
c. potassium	the state of the s					
B. Compare the co	trioxalatoierrate (III) tr	ihydrate				
	onductance of the comp	ihydrate plexes with that of M/1000	0 solution of	NaCl, Mg	$_{2}Cl_{2}$ and L	iCl ₃ .
 Systematic Qu 	onductance of the compalitative Organic Analy	ihydrate blexes with that of M/1000 ysis of Organic Compoun	0 solution of ds possessir	NaCl, Mg ng monofu	gCl ₂ and L inctional g	iCl ₃ .
 Systematic Qu COOH, phenol 	alitative Organic Analy ic, aldehydic, ketonic,	ihydrate plexes with that of M/1000 ysis of Organic Compoun amide, nitro, amines) and	0 solution of ds possessir preparation	NaCl, Mg ng monofu of one der	gCl ₂ and L inctional grivative.	iCl ₃ . roups
 Systematic Qu COOH, phenol Brief Descript 	alitative Organic Analy ic, aldehydic, ketonic, a	ihydrate blexes with that of M/1000 ysis of Organic Compoun amide, nitro, amines) and – learning component	0 solution of ds possessir preparation	NaCl, Mg ng monofu of one der	gCl ₂ and L inctional grivative.	iCl ₃ . roups
 Systematic Qu. COOH, phenol Brief Description http://nopr.nis/ 	ic, aldehydic, ketonic, a ion of self-learning/ E cair.res.in/bitstream/12	ihydrate blexes with that of M/1000 ysis of Organic Compoun amide, nitro, amines) and – learning component 3456789/7002/1/LJCT%2	0 solution of nds possessir preparation 013%281%2	NaCl, Mg ng monofu of one der	gCl ₂ and L inctional g vivative.	iCl ₃ . roups (
 Systematic Qu. COOH, phenol Brief Descripti http://nopr.nise http://egvanko 	ic, aldehydic, ketonic, ion of self-learning/ E cair.res.in/bitstream/12 sh.ac.in//handle/12345	ihydrate blexes with that of M/1000 ysis of Organic Compoun amide, nitro, amines) and <u>– learning component</u> 3456789/7002/1/IJCT%2 6789/85366	0 solution of nds possessir preparation 013%281%2	NaCl, Mg ng monofu of one der	gCl ₂ and L inctional g ivative. 87.pdf	iCl ₃ . roups
 Systematic Qu COOH, phenol Brief Description http://nopr.nise http://egyanko http://www.eg 	in of self-learning/ E cair.res.in/bitstream/12 sh.ac.in//handle/12345 vankosh.ac.in/bitstream	ihydrate olexes with that of M/1000 ysis of Organic Compound amide, nitro, amines) and - learning component 3456789/7002/1/IJCT%2 6789/85366 n/123456789/15885/1/Ext	0 solution of nds possessir preparation 013%281%2 periment-4.r	NaCl, Mg ng monofu of one der 29%2084-3	gCl ₂ and L nctional g ivative. 87.pdf	iCl ₃ . roups
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1. Name of the Dep	artment: Chemistry				1.1.1.1.1.1	
2. Course Name	Chemistry of Main	Group Elements,	L	Т	P	
	Theories of Acids an	nd Bases				
3. Course Code	17030620		4	0	0	
4. Type of Course (use tick mark)	Core ()	DSE (√)	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even (✓)	Odd ()	Either	Every
(if any)		(use tick marks)			Sem ()	Sem
7. Total Number of	Lectures, Tutorials,	Practical				
Lectures $= 52$		Tutorials = 0	Practica	$\mathbf{nl} = 0$		
8. Course Descripti	ion					
This course provides	s students the knowled	ge of Acids and Bases,	General Prine	ciples of M	letallurgy,	s- and
<i>p</i> -Block Elements, N	Noble gases, inorganic	polymers, etc. It offers of	discussion or	n various te	erms such	as
minerals, ores, conce	entration, calcination,	roasting, refining, princi	ples of oxida	ation and re	eduction a	S
applied to the extrac	tion procedures. It also	o includes the patterns a	nd trends exh	nibited by s	s and p blo	ock
elements and their co	ompounds with empha	sis on synthesis, structu	re, bonding a	and uses.		
9. Course Objectiv	es					19 cashing
The objectives of thi	is course are to:					
1. Introduce the kn	lowledge of acids, base	es and Metallurgy				
2. Introduce the kn	lowledge of s- and p-B	lock Elements				
Attain the know	lodge of Noble gases	es of oxidising and reduc	cing agents			
4. Attain the know	ledge of Noble gases a	ind morganic polymers.				the state
Upon successful con	nes (COS)	the student will be able	tat			
1 Evaluin variaus	ipletion of this course	, the student will be able	e to:			
2 Lindonstand dat	s concepts related to ac	nus, bases, and metallur	gy			
2. Understand det	an properties of s- and	p-Block Elements				
A Dredict the role	paration and properties	s of Noble gases and inc	organic polyn	ners		
4. Predict the role	of oxidizing and redu	cing agents in chemistry				
II. Unit wise detaile	ed content	12 17:41 641 14	A . 1 . D	10	1.5.1	-
	Number of lectures =	13 Title of the unit:	: Acids, Base	es and Ger	neral Prin	ciples
Prönstad Lowry oor	agent aggiugate gaide	of Metallurgy	athe of eside			
substituent and solve	ncept, conjugate actus	lavalling solvents Law	gins of acids	and bases,	, effects of	
Lewis acids and base	es Lux-Flood concent	and solvent system con	is aciu-base	d soft acid	assilicatio	
(HSAB concept) Ar	plications of HSAB n	rocess	cept. Halu al	iu son aciu	is and base	55
Chief modes of occu	irrence of metals based	l on standard electrode r	otentials El	lingham di	agrams for	r
reduction of metal or	xides using carbon and	l carbon monoxide as re	ducing agent	s. Methods	s of purific	ation
of metals (Al, Pb, Ti	, Fe, Cu, Ni, Zn, Au):	electrolytic refining, zor	ne refining. v	an Arkel-c	le Boer pr	ocess
Parting Process, Mor	nd's process and Kroll	Process.			ar Boor pr	
Unit-2 Number	r of lectures = 13	Title of the unit:	s- and p-Ble	ock Eleme	nts	
Periodicity in s- and	p-block elements with	respect to electronic co	nfiguration,	atomic and	ionic size	
ionization enthalpy,	electron gain enthalpy	, electronegativity (Paul	ing scale).Ge	eneral char	acteristics	of s-
block metals like der	nsity, melting and boil	ing points, flame colour	and reducing	g nature. O	xidation s	tates of
s- and <i>p</i> -block eleme	ents, inert-pair effect, c	liagonal relationships an	d anomalous	behaviour	r of first m	ember
of each group. Allot	ropy in C, P and S. Co	mplex forming tendency	of s block e	lements an	d a prelim	inary
idea of crown ethers	and cryptates, structur	es of basic beryllium ac	etate, salicyl	aldehyde/a	acetylacet	onato
complexes of Group	1 metals. Solutions of	alkali metals in liquid a	mmonia and	their prop	erties. Cor	nmon
features, such as ease	e of formation, solubil	ity and stability of oxide	s, peroxides,	, superoxid	les, sulpha	tes and
carbonates of s-block	k metals.					
Unit-3 Number	r of lectures = 12	Title of the unit: S	Structure, B	onding, P	roperties	and
		Applications of p	-block Elem	ents		
Structure, bonding an	nd properties (acidic/ b	basic nature, oxidizing/ r	educing natu	ire and hyd	trolysis) o	f the
following compound	is and their application	s in industrial and envir	onmental che	emistry wh	erever app	olicable
Diborane and concep	of of multicentre bondi	ng, hydrides of Groups	$13 (BH_3), 14$, 15, 16 an	d 17.	1
	1	. 1	11			
۸ .	0/A	the in	Reh			
	S/ Jr		Tot			
0 /	4		A			
	~					



Oxides of N and P, Oxoacids of P, S and Cl. Halides and oxohalides of P and S (PCl₃, PCl₅, SOCl₂ and SO₂Cl₂). Interhalogen compounds. A brief idea of pseudohalides.

Unit-4Number of lectures = 14Title of the unit: Noble Gases and Inorganic PolymersRationalization of inertness of noble gases, clathrates, preparation and properties of XeF_2 , XeF_4 and XeF_6
, bonding in these compounds using VBT and shapes of noble gas compounds using VSEPR Theory. Types
of inorganic polymers and comparison with organic polymers, structural features, classification and
important applications of silicates. Synthesis, structural features and applications of silicones. Borazines
and cyclophosphazenes – preparation, properties and reactions. Bonding in (NPCl₂)₃.

12. Brief Description of self-learning/ E - learning component

- 1. https://www.chem.uci.edu/~lawm/11-4.pdf
- 2. https://www.slideshare.net/DevanshGupta25/classification-of-inorganic-polymers
- 3. http://what-when-how.com/materialsparts-and-finishes/inorganic-polymer/
- 4. https://www.tau.ac.il/~jortner/Publications/Pub1-200/61.pdf

13. Books Recommended

- 1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991, ISBN 978-0412402906
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley, ISBN 978-0471505327.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons ISBN 978-0471629788
- 4. Greenwood, N.N. & Earnshaw. Chemistry of the Elements, Butterworth-Heinemann. 1997, ISBN 978-0750633659.
- 5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002, ISBN 978-0840068460.
- Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry 4th Ed., Pearson, 2010, ISBN 978-0321811059.
- Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010), ISBN 978-0199236176



1. Name of the Depar	tment: Chemistry					
2. Course Name	Chemistry of Main (Group Elements,	L	Т	Р	
	Theories of Acids an	nd Bases Lab		1999 1995		
3. Course Code	17030621		0	0	4	
4. Type of Course (us	e tick mark)	Core ()	DSE (√)	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even ()	Odd ()	Either	Every
(if any)		(use tick marks)			Sem ()	Sem ()
7. Total Number of L	ectures, Tutorials, Pra	acticals				
Lectures = 0		Tutorials = 0	Practical	= 52 hrs.	a second al	1
8. Course Description						
This course provides st	udents with practical e	xperience of the techniqu	es of analysi	s of quanti	tative data	a. It is
addressed to students v	ho have little or no exp	perience of using quantita	ative data and	d it aims to	enable st	udents to
develop an understandi	ng of basic and interme	ediate quantitative chemic	cal analysis 1	nethods ar	d the abil	ity to use
these methods. This co	urse includes iodimetri	c and gravimetric titration	ns by conside	ering the e	xample of	date to
date life.						
9. Course Objectives					1. A. 1. 1. 1.	
The objectives of this c	ourse are to:					
1. Learn iodometric e	stimations of various s	olutions				
2. Understand Gravin	netric estimation techni	ques				
3. Attain knowledge	of preparation of salt co	omplexes				
4. Learn the iodimetri	c estimation of differen	nt components				
10. Course Outcomes	(COs)			1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		
Upon successful compl	etion of this course, the	e student will be able to:				
1. Predict the applicat	tion of analytical metho	ods based on titrations viz	iodimetric,	gravimetri	c, and isol	ation,
Solve most import	is, elc.	ativa analysia				
 Solve most importa Synthesize various 	salt complexes	allve analysis				
4 Apply quantitative	analysis in daily life					
11. List of experiment	s (Students has to per	form 5 experiments)				
1. Iodometric estimat	ion of potassium dichro	omate and copper sulphate	e			
2. Iodimetric estimati	on of antimony in tarta	remetic	•			
3. Estimation of amou	int of available chloring	e in bleaching powder and	d household	bleaches		
4. Estimation of iodin	e in iodized salts.			oreactics		
5. Iodimetric estimati	on of ascorbic acid in f	ruit juices.				
6. Estimation of disso	lved oxygen in water s	amples.				
7. Gravimetric estima	tion of sulphate as bari	um sulphate.				
8. Gravimetric estima	tion of aluminium as o	ximato complex				
9. Preparation of the t	following: potash alum,	, chrome alum, tetraammi	inecopper(II)	sulphate i	nonohydr	ate,
potassium trioxalat	oferrate(III)any two, in	cluding one double salt a	nd one comp	olex).		
12. Brief Description	of self-learning/ E – le	arning component				
1. https://www.acader	nia.edu/32601929/Exp	eriment_no1_Iodometri	ic_titration_	of_potassiu	um_dichro	mate_an
d_sodium_thiosulp	hate_Objective					
2. https://www.cutm.a	ac.in/pdf/Env Engg Lat	Manual.pdf				
3. https://www.slidesl	nare.net/Ernest13/deter	mination-of-sulphate-as-l	barium-sulph	nate		
13. Books Recommend	ded					
1. Svehla, G. Vogel's	Qualitative Inorganic	Analysis, Pearson Educat	ion, 2012, IS	BN 978-8	13177371	0.
2. Mendham, J. Voge	l's Quantitative Chemi	cal Analysis, Pearson, 20	09, ISBN 97	8-8131723	258	
W >	A CO	y L	Ash.			



1. Name of the D	epartment: Mathema	atics				
2. Course	Integral	L		Τ		P
Name	Transformation		1			
3. Course Code	17030622	4		0		0
4. Type of Course	e (use tick mark)	Core ()	DSE	AEC ()	SEC	OE ()
			()			-
5. Pre-requisite		6. Frequency	Even	Odd ()	Either	Every
(if any)		(use tick marks)	()		Sem ()	Sem ()
7. Total Numbe	r of Lectures, Tutoria	als, Practical				
			12.1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
Lectures $= 52$		Tutorials = 0		Practical =	= 0	
8. Course Descr	iption:					

This course focuses on various integral transforms which are required to analyze problems in engineering and scientific professions. The topics covered include Laplace transforms, inverse Laplace transform, Application of Laplace transform to solve ordinary differential equations, Fourier series, Fourier transforms and discrete Fourier Transform, z-transformations. The mathematical skills derived from this course form a necessary base for analytical and design concepts encountered in the program.

9. Course Objectives:

The aim is to develop the knowledge of different transforms and their applications among students. To equip with the methods of finding Laplace transform and Fourier Transforms of other functions. To make them familiar with solving differential equations, partial differential equations, and Boundary Value problems using Laplace Transforms, and Fourier Transforms.

10. Course Outcomes (COs):

After completing the course, students are expected to be able:

- 1. To apply Laplace transform and inverse Laplace transform in solving differential equations and integral equations arising in network analysis, control system and other fields of engineering.
- 2. To Derive Fourier series representation of Periodic functions.
- 3. To determine Fourier transform, Fourier sine and cosine transform of a function.
- 4. To apply z-transformation on real life problems like signals and systems.

11. Unit	wise	detailed	content	
TT A	T			 10

Unit – 1	Number of lectures = 13	Title of the unit: Laplace Transform And Its
		Applications

Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac-delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

Unit – 2 Number of lectures = 13

es = 13 Title of the unit: Fourier Series

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Definition of periodic function, determination of Fourier coefficients, Fourier expansion of periodic function in a given interval of length 2π , Fourier series of even and odd functions, Fourier series in an arbitrary interval, Half-range Fourier sine and cosine expansions.

Unit – 3 Number of lectures = 13 Title of the unit: Fourier Transforms And Its Applications

Fourier integral, Fourier transform, Complex Fourier transform, Inverse transforms, Convolution theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Finite Fourier transforms, Parseval's identity.

Unit -4 Number of lectures = 13 Title of the unit: Z-Transforms And Its Applications

Difference equations, Basic definitions, Z-transform definition, Standard z-transforms, ROC, Damping rule, Shifting rule, Initial value and final value theorems (without proofs) and problems, Inverse z-transform, Simple problems. Applications-solutions of difference equations using z-transforms.

12. Brief Description of self-learning / E-learning component

1. https://www.youtube.com/watch?v=KqokoYr h1A

2. <u>https://www.youtube.com/watch?v=spUNpyF58BY</u>

13. Books Recommended:

- Erwin Kreyszig: Advanced Engineering Mathematics (10th ed.), Wiley India Pvt. Ltd, 2015.
- 2. Michael Greenberg: Advanced Engineering Mathematics (2nd ed.), Pearson Education, 1998.
- 3. Baidyanath Patra, An Introduction to Integral Transforms, CRC Press, (1st ed.), 2018.
- 4. A.V. Oppenheim, A.S. Willsky and S. H. Nawab, Signals and Systems (2nd ed.), Prentice Hall, New Jersey, 1996.

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1. Name of the D	epartment: Mat	hematics				
2. Course	Integral	L	ſ		(P
Name	Transformatio					
	n Lab					
3. Course Code	17030623	0	0		4	4
4. Type of Cours	e (use tick	Core ()	DSE (AEC ()	SEC ()	OE ()
mark)						
5. Pre-requisite		6. Frequency	Even (Odd ()	Either	Every
(II any)		(use tick			Sem ()	Sem ()
7 Total Number	of Lootumos Tut	marks)				
$7.10 \text{ for the formula of the f$	of Lectures, 100	Tutorials –	0	Duratical	- 50	
8 Course Descri	ntion	i utoriais –	U	r ractical	- 52	
This course is d	esigned to empl	hasize the knowl	ledge of in	ntegral tra	neformatic	n using
MATLAB We us	e MATLAR to s	olve various inter	tral transfor	mations I	anlace Tr	ansform
Inverse Laplace T	ransform. Applica	ation of Laplace	transforms	to solve o	rdinary di	fferent ial
equations. Fourier	series, Fourier	transforms and	Fourier seri	ies expans	sion of a	periodic
function.					or u	perioure
9. Course Object	ives:					
Many applications	in engineering	physics, geolog	y and oth	er specifi	cations co	ontaining
complicated proble	ems usually requi	re solving one of	the integra	l transform	nation prol	plems. In
this course student	s learn the classi	fication of many	complicated	problems	and how	to attain
their solutions. A	pplication of Lap	lace and Fourier	transforms	for obtaini	ng an app	roximate
solution to the prob	elems with desired	accuracy.				1
10. Course Outcon	nes (COs):				•	
After completing th	nis course student	will be able:				
	1 course, student					
1. Implement integ	gral transformatio	n in MATLAB.				
2. To develop the	knowledge of dif	terent transforms a	and its appli	cations an	nong stude	nts using
MATLAB.		1				
3. Practical and th	eoretical knowled	ge of schemes for	integral tran	nsformatio	n.	
4. Practical and t	heoretical knowle	edge of schemes	for solving	, Laplace	transform,	Fourier
transform and z	-transformation.					
11. List of practical	ls to perform in co	omputer lab using	software MA	ATLAB		
1. Solution of La	place transforms	of derivatives and	integrals			
2. Solution of Un	it step function ar	d Dirac-delta fun	ction			
3 Solution of an	lication to solve	simple linear and a	imultanoou	different	al equation	nc
4 Solution of det	ermination of East	rier coefficients	munaneou	sumerent	al equation	IIS.
5. Solution of De	union conice of	n and a dd C				
5. Solution of For	urler series of eve	n and odd function	15.			
6. Solution of wa	ve equations and	Laplace equations.				
7. Solution of ind	ependent variable	and transformation	on variable.			
8. Solution of For	urier transform us	ed in the signal, an	nd also creat	te the vecto	or.	
9. Solution of z-ti	ransforms involvin	ng Heaviside funct	tion and Bin	omial coe	fficient.	
10. Solution of dif	ference equations	using z-transform				
12. Brief Descrinti	on of self-learnin	g / E-learning co	mponent			
1 01	0 0.0	B tearning co				
Howard	malin		0	C-S-	Lelite	



1. <u>https://in.mathworks.com/help/symbolic/compute-z-transforms-and-inverse-z</u> <u>transforms.html</u>

2. https://in.mathworks.com/help/symbolic/ztrans.html

- 3. https://in.mathworks.com/help/matlab/math/fourier-transforms.html
- 4. https://in.mathworks.com/help/symbolic/sym.laplace.html
- 5. <u>https://www.youtube.com/watch?v=xVCINJxtj78</u>

13. Books Recommended

1. Alexander D. Poularikas, Transforms and Applications Primer for Engineers with Examples and MATLAB, CRC Press, 2010.

2. Prem K. Kythe and Michael R. Schäfferkotter, Handbook of Computational Methods for Integration, Chapman & Hall/CRC, 2005.

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1.	Name of the	Department: Mathem	atics			an Gran	
2.	Course	Partial Differential	-				D
	Name	Equations	L		U		P
3.	Course	17030624	4		1		0
	Code		4		,		0
4.	Type of Cou	rse (use tick mark)	Core ()	DSE	AEC ()	SEC	OE ()
				(1)		0	
5.	Pre-		6. Frequency	Even	Odd ()	Either	Everv
	requisite		(use tick	(~		Sem	Sem ()
	(if any)		marks)			0	
7.	Total Numb	er of Lectures, Tutoria	ls, Practical		and the second		
Le	ctures = 52		Tutorials = 0	Prac	ctical = 0		
8.	Course Desc	ription:					
For	rmation and	classification of first-	order PDEs. Lines	ar and ou	asilinear	first-orde	r PDEs
Int	egral surfaces	, Nonlinear first-order	PDEs and Secon	d-Order F	DEs. Sec	ond-Orde	er PDEs.
De	rivation of the	heat equation, Method	of separation of v	variables,	Fime indep	pendent b	oundary
con	nditions, Tim	e-dependent boundary	conditions, Du	hamel's p	orinciple,	Wave a	equation,
De	rivation of wa	ve equation, Infinite str	ing problem, D'Al	embert sol	lution of th	ne wave e	equation,
La	place's Equation	on and Method of Green	's Functions				
9.	Course Obj	ectives:					
Th	e course inclu	udes initial and bound	ary value problem	ns for Par	rtial Diffe	rential E	quations
(PI	DEs) of first a	nd second order, and i	ncludes, to a limit	ed extent,	systems o	f such ea	juations.
Em	nphasis is on th	ne qualitative behavior of	of solutions of Part	ial Differe	ntial Equa	tions.	
10.	Course Outc	comes (COs):					
Afti 1. 2 3 4. 11. Un	 To apply a range of the second seco	this course, students w range of techniques to ff rate accurate and efficies in the theory of PDEs. rate capacity to model p ve equations). oblem solving using con iverse situations in physical contexts. tailed content mber of lectures = 15	ill be able: ind solutions of sta ent use of Fourier a ohysical phenomen ncepts and techniqu sics, engineering, f	ndard PDF nalysis tec a using PE ues from P inancial m : First-Or	Es. Chniques and DEs (in par DEs and F athematics der Partia	nd their ticular us ourier ar and in o	sing the alysis ther
		aber of rectures - 15	Equations	. Flist-Of	uer i artia	u Dillere	
Inte Fire ord	egral Curves a st-order PDEs ler PDEs, Cau	and Surfaces of Vector , Formation and classif chy's problem for first o	Fields, Solving D fication of first-ord rder PDEs.	Es of the er PDEs,	form: dx/λ Linear and	P = dy/Qquasilin	d = dz/R, ear first-
Un	it – 2 Numl	ber of lectures = 13	Title of the unit order PDEs and	: Integral Second-(surfaces, Order PD	Nonline Es	ar first-
Inte cha Sec	egral surfaces tracteristics, C cond-Order PI	passing through a g compatible systems, Cl PEs, Classification, Can	given curve, Non narpit's method, J onical forms.	linear firs acobi's m	t-order Plethod for	DEs, Me nonlinea	ethod of r PDEs,
	Houses	Andiv	for		c.s. hal	He	



Derivation	of the heat equation. Uniqueness, Continuous dependence, Method of separation.
variables.	Time independent boundary conditions. Time-dependent boundary condition
Duhamel's	principle, Wave equation, Derivation of wave equation, Infinite string problem
D'Alember	t solution of the wave equation, Semi-infinite string problem, Finite vibrating strin
problem, M	lethod of separation variables, Inhomogeneous wave equation.
Unit – 4	Number of lectures = 12 Title of the unit: Laplace's Equation and Metho
	of Green's Functions
Basic conc	ents of Laplace's equation Types of boundary value problems Green's identity at
fundamenta	al solution. Poisson integral formula. Method of separation of variables. Dirichl
problem for	r the rectangle. Integral formulation of Green's function. Method of Green's function
for the Lap	lace, heat and wave equations.
10 0 1 00	
12. Brief D	escription of self-learning / E-learning component
1. <u>http</u>	s://nptel.ac.in/courses/111108144
2. <u>http</u>	s://nptel.ac.in/courses/111104145
3. <u>http</u>	s://archive.nptel.ac.in/courses/111/107/111107111/
4. <u>http</u>	is://archive.nptel.ac.in/courses/111/105/111105093/
13. Books	Recommended
1. C. Co	instanda: Solution Techniques for Elementary Partial Differential Equations (3rd ec
Chapı	man & Hall/CRC, New York, 2016.
2. S. J.	Farlow: Partial Differential Equations for Scientists and Engineers, Dov
Public	cations Inc. New York, 1993.
3. F. Joh	in: Partial Differential Equations (4 th ed.), Springer-Verlag, New York, 1982.
4. I. N.	Sneddon: Elements of Partial Differential Equations, Dover Publications, New Yor
2006.	
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197	madin 199 c.s.
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1. Name of the De	epartment: Math	nematics						
2. Course Name	Partial	L		T		P		
	Differential							
	Equations Lab				C. Contraction			
3. Course Code	17030625	0		0		4		
4. Type of Course mark)	4. Type of Course (use tick Core () DSE (*) AEC () SEC OE ()							
5. Pre-requisite		6. Frequency	Even	Odd ()	Either	Every		
(if any)		(use tick	(Sem	Sem ()		
		marks)			0			
7. Total Number	of Lectures, Tut	orials, Practical			1 <u>2</u>	1		
Lectures = 0		Tutorials =	• 0	Practical =	= 52			
8. Course Descrip	otion:							
This course is desig	ned to emphasize	e the knowledge of	of partial di	fferential eq	uations.	Emphasis		
is placed on differ	rent forms of lin	near and non-lin	ear Partial	differential	equation	ns. Upon		
completion, student	s should be able	to write the pro	grams for s	olving the	partial di	fferential		
equations in MATL	AB or other softw	vare.						
9. Course Object	ives:							
1. Give an acco	ount of basic conc	cepts and definitio	ns for partia	al differentia	al equation	ons.		
2. Use methods	s for obtaining the	e solutions of heat	and wave e	equations.				
3. Describe soi	ne simple numer	ical solution techi	niques and	be familiar	with math	hematical		
software for	partial differentia	al equations.						
4. Use MATLA	AB for the visuali	zation of solution	s to PDEs.		1998 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -			
10. Course Outcom						Constant of the second		
After completing t equations using MA	he course, stude TLAB.	nts are expected	to be able	to solve p	oartial di	fferential		
11. List of Practica	l's (using any on	e from C++, MA	ATLAB)					
1. To solve the	problem of singl	e partial differenti	ial equation	s.				
2. Determine the Dirichlet and Neumann boundary conditions.								
3. To solve the	heat equation.							
4. To solve the	PDEs with disco	ntinuity.						
5. To solve the wave equation with initial conditions.								
6. To solve nonhomogeneous boundary conditions and steady-state solutions for heat								
equations.								
7. Implement the maximum principle to establish the uniqueness of the solution for the								
heat equation	ns.	-1 C.1		11 0				
8. Determine the D'Alembert's solution of the initial value problem for wave equations.								
9. To solve the energy integrals and determine the uniqueness of the solutions for the wave								
10. To solve boundary value problems in rectangular accordinates for Lonloss?								
11. To solve Neumann problems and mixed boundary conditions for Laplace's equations.								
12 Brief Descriptio	an af self-learnin	and mixed bounda	mponent	ns ior Lapia	ice s equa	ations.		
1. https://in ma	thworks com/heli	p/matlab/math/par	tial-differen	tial-equation	ns html			
2. https://in.ma	thworks.com/hel	p/matlab/example	s html?cate	vorv=partial	-differen	tial-		
equations&s tid=CRUX topnav								
3. https://in.mathworks.com/help/matlab/math/solve-single-nde.html								
4. https://in.mathworks.com/help/matlab/math/solve-pde-with-material-interface.html								
13. Books Recomm	ended	in the math sol	i pac with	i mater ar "II				
0	0 1:10			1	1			
. Jalon	bratile	lat	p		00			
NO.	1	K		C-J- K	when			

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- 1. Matthew P. Coleman, An Introduction to Partial Differential Equations with MATLAB(2nd ed.), Chapman and Hall/CRC, 2013.
- 2. Amos Gilat: MATLAB: An Introduction with Applications (8th ed.), Wiley India Edition, 2020.

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1.	1. Name of the Department: Mathematics						
2.	Course	Numerical	L		Τ]	Р
	Name	Methods					
3.	Course	17030626	4	-	0		0
	Code						
4.	4. Type of Course (use tick		Core ()	DSE (AEC ()	SEC ()	OE ()
	mark)						
5.	Pre-		6. Frequency	Even (Odd ()	Either	Every
	requisite		(use tick			Sem ()	Sem()
	(if any)		marks)				
7. Total Number of Lectures, Tutorials, Practical							
Lectures = 52			Tutorials = 0 Pr		ractical = 0		
8 Course Description:							

This course analyzed the basic techniques (direct and iterative methods) for the efficient numerical solution of problems in science and engineering. Topics covered are: Number representation and errors, Polynomials, Finite Difference, Interpolation and Approximation of function, Interpolation and approximation, Numerical differentiation, Numerical integration, Systems of linear equations, Solution of differential equations.

9. Course Objectives:

Many applications in engineering, physics, geology and other specifications containing complicated problems that will require one of the numerical methods to be solved. In this course students will learn the classification of many complicated problems and the suitable numerical methods for obtaining an approximated solution to these problems with desired accuracy.

10. Course Outcomes (COs):

On completion of this course, the students will be able:

- 1. To demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
- 2. To derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear, and the solution of differential equations.
- 3. To apply numerical methods to obtain approximate solutions to mathematical problems.
- 4. To evaluate the system of linear equations and ordinary differential equations using numerical methods.

11. Unit wise detailed content									
Unit – 1	Number of lectures = 12	Title	of	the	unit:	Errors	and	Solution	of
		Transcendental and Algebraic Equations							

Representations of numbers, Round off error, Truncation error, Significant error, Error in numerical computations, Bisection, secant, Regula-Falsi, fixed-point, Newton-Raphson, Graffe's and Muller's methods.

Unit – 2	Number of lectures = 15	Title of the unit: Finite Difference, Interpolation
		and Approximation of Function

Difference operators and their relations, Difference table, Newton interpolation, Central difference formulae of Gauss, Newton divided difference formula, Lagrange interpolation, Hermite interpolation, Stirling formula, Bessel formula, Cubic spline interpolation, Curve fitting by least square method (linear, polynomial, geometric).

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Unit – 3	Number of lectures = 10	Title of the unit: Numerical differentiation and
		Numerical Integration

Numerical differentiation, Numerical integration, Newton-Cotes formulae, Trapezoidal, Simpson's and Weddle's rules, Gaussian quadrature (Gauss-Legendre and Gauss-Chebyshev quadrature).

Unit – 4	Number of lectures = 15	Title of the unit: Solution of a System of Linear
		Equations, Eigenvalue Problems and Solution of
		Ordinary Differential Equation (ODEs)

Partial and complete pivoting for system of linear equations, LU decomposition method, Solution of tridiagonal system of equations: Gauss-Seidel, Gauss-Jacobi. Eigenvalue problem: Power method, Solution of ODEs: Picard's method, Taylor's, Euler's and modified Euler's methods, Runge-Kutta method of fourth order.

12. Brief Description of self-learning / E-learning component

- 1. https://nptel.ac.in/courses/111107105
- 2. https://nptel.ac.in/courses/111106101

13. Books Recommended

- 1. J. H. Mathews and K. K. Fink: Numerical Methods using MATLAB (4th ed.), Prentice Hall Inc., 2004.
- 2. M. K. Jain, S.R.K. Iyengar and R.K. Jain: Numerical Methods: For Scientific and Engineering Computation (7th ed.), New Age International Publishers, 2019.
- S. S. Sastry: Introductory Methods of Numerical Analysis (5th ed.), PHI Learning, New Delhi, 2012.

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1. Name of the De	partment: Math	ematics				
2. Course Name	Numerical	L		Г		P
	Methods Lab					
3. Course Code	17030627	0		0		4
4. Type of Course	e (use tick	Core ()	DSE (AEC ()	SEC	OE ()
mark)					0	
5. Prerequisite		6. Frequency	Even (🖍	Odd ()	Either	Every
(II any)		(use tick			Sem	Sem ()
7 Total Number	of Lectures Tut	marks)				
Lectures $= 0$	of Lectures, rut	Tutorials =	0	Practical =	= 52	
8. Course Descrip	tion:	I dtorrais	<u> </u>	Tractical	52	
Obtaining numerica	l solution of a p	oblem unto an ac	centable en	ror requires	a lot of	iterations
which consumes a 1	ot of time if done	e manually. Chang	ces of errors	are also ve	erv high i	n manual
calculation. To ove	rcome these we	introduce this co	ourse in wh	ich softwar	es like N	ATLAB
provides numerica	l solutions to	various problems	including	differentia	ation, int	tegration.
differential equation	is and system of e	equations.	U		,	0
9. Course Objecti	ves:					
Students will be int	roduced to variou	us tools and techn	iques in M.	ATLAB that	at will he	lp him to
analyze the solution	n of a problem l	both numerically	and graphic	cally. Stude	ents can	solve the
system of linear eq	uations using iter	rative as well as	direct meth	ods on MA	TLAB. 7	They will
learn how to design	n programmes in	MATLAB for n	numerical in	tegration, o	differentia	ation and
interpolation.		<u></u>				
10. Course Outcom	ies (COs):	<u></u>		· · · · · · · · · · · · · · · · · · ·		
After completing th	is course, student	s will be able:				
1. To solve a sy	stem of linear eq	uations using itera	ative and di	rect method	ls.	
2. To learn how	v to interpolate th	e given set of valu	ues using M	ATLAB.		
3. To write pro	grammes in MAT	LAB for numeric	al different	iation and in	ntegration	
4 To obtain nu	merical solutions	of an Ordinary di	ifferential e	ination and	nlot their	aranha
1. For obtain hu	to porform in con	or an Orumary u			plot then	graphs
11. List of practical	to perform in cor	inputer lab using s	onware MA	TLAB		
Hor white	proalité		foot	<u> </u>	s. Lely	lea_



1.	Solution	of	nonlinear	equations	in	a single	variable	using	the	method	of	successive
	bisection.		1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.									

- Solution of nonlinear equations in single variables using the Newton-Raphson, secant, Regula-falsi and modified Euler's methods.
- Solution of a system of simultaneous algebraic equations using the Gaussian elimination procedure.
- Solution of a system of simultaneous algebraic equations using the Gauss-Jacobi iterative method.
- 5. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method employing the technique of successive relaxation.
- 6. Numerical solution of an ordinary differential equation using the Euler's method.
- Numerical solution of an ordinary differential equation using the Runge-Kutta 4th order method.
- Numerical solution of an ordinary differential equation using the predictor-corrector method.
- Numerical solution of a system of two ordinary differential equations using numerical integration.
- 10. Numerical solution of an elliptic boundary value problem using the method of finite differences.

12. Brief Description of self-learning / E-learning component

- 1. https://youtu.be/5W46xcVInL8?list=PLRWKj4sFG7-6 Xr9yqg6SMr F80KdFVhN
- 2. https://youtu.be/bsgPR0IWiTg?list=PLRWKj4sFG7-6 Xr9yqg6SMr F80KdFVhN
- 3. https://youtu.be/51PwCoFtyXw?list=PLRWKj4sFG7-6_Xr9yqg6SMr_F80KdFVhN

13. Books Recommended

- 1. Lester W. Schmerr: Engineering Dynamics 2.0: Fundamentals and Numerical Solutions, Springer International Publishing, 2019.
- 2. Brian H. Hann and Daniel T. Valentine: Essential MATLAB for Engineers and Scientists (3rd ed.), Academic Press Inc, 2007.
- 3. Richard L. Burden, J. Douglas Faires and Annette M. Burden: Numerical Analysis (10th ed.), Cengage Learning, 2016.

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SEMESTER-VII (DSE)



1. Name of the D	epartment: Physics	\$				
2. Course Name	Mathematical and	L		Т		Р
	Computational					
3. Course Code	17030701	4		0	• 2	P 0 GE () Every Sem () hes that se gives am's core of various of various hethods to f various of various calculus of vectors r product, lerivative. operators. s. Flux of ications.
4. Type of Cours	e (use tick mark)	Core ()	DSE $()$	AEC ()	SEC ()	GEO
5. Pre-requisite		6. Frequency	Even ()	$Odd(\sqrt{)}$	Either	Every
(If any)		(Use tick		0.000	Sem ()	Sem ()
Total Number	of Lasturg Tuter	marks)				
Lectures = 52	of Lectures, Tutori	Tutorials:	= 0	Practical	- 0	
. Course Descri	otion:	I utoriais	-0	Tattital	- 0	
ave been develop nathematical skil ubject. . Course Object The aim of this of nathematical tech 0. Course Outco after completing ifferent set of prosection 1. Unit wise deta Unit-1 Numb Errors and error A	bed and used to the s ls to address formalis ives course is to understaniques in solving Ph omes (COs): this course, Student blems in theoretical ailed content ber of lectures = 13 nalysis Truncation a	tudy of diverse j sms utilized in t and the focus o sysics problems. s will be able to and experiment Title of the un and round off err	physical ph he bachelor f the cours o apply var al physics. iit: Calculu ors, Absolu	enomenon. 's level phy se is on app rious mathe	This cours sics progra plication c matical m	ethods to
ooint computation curves. Approxim Order Differentia Homogeneous Equ	s. Intuitive ideas of ation: Taylor and bi l equations: First lations with constant	continuous, dif inomial series (s Order Differer t coefficients.	ferentiable, statements itial Equat	etc. functi only). First ions and	ons and p Order and Integrating	lotting of d Second g Factor.
Jnit – 2 Numb	er of lectures = 16	Title of the un	it: Vector	Algebra an	d Vector	Calculus
Linear independer under rotations. S Scalar triple produ Gradient of a scal Ordinary Integrals a vector field. Gau	nce, completeness, b calar product and it act. Scalar and Vect ar field. Divergence of Vectors. Notion c ss' divergence theore	basis and repress s invariance un- tor fields. Direc and curl of a v of infinitesimal l em, Green's and	entation of der coordin tional deriv rector field. ine, surface Stokes The	vectors. Pr nate rotation vatives and Del and L and volum orems and	operties o ns. Vector normal de aplacian o e elements their applie	f vectors product, erivative. operators. s. Flux of cations.
Unit – 3 Numb	er of lectures = 10	Title of the un	it: Orthogo	onal Curvil	linear	
	X		JL	wl	Mul	r Jo



Coordinates

Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.

Unit – 4 Number of lectures = 13 Title of the unit: Matrices

Addition and Multiplication of Matrices. Null Matrices. Diagonal, Scalar and Unit Matrices. Transpose of a Matrix. Symmetric and Skew-Symmetric Matrices. Conjugate of a Matrix. Hermitian and Skew- Hermitian Matrices. Singular and Non-Singular matrices. Orthogonal and Unitary Matrices. Trace of a Matrix. Inner Product. Eigen-values and Eigenvectors. Diagonalization of Matrices. Solutions of Coupled Linear Ordinary Differential Equations. Functions of a Matrix.

12. Books Recommended

- 1. Differential Equations, George F. Simmons, 2007, McGraw Hill
- 2. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
- 3. Mathematical methods in the Physical Sciences, M. L. Boas, 2005, Wiley.
- 4. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
- 5. Mathematical Methods for Physicists, G.B.Arfken, H.J.Weber, F.E.Harris, 2013, 7th Edn., Elsevier.

13. Online Links

- 1. https://nptel.ac.in/courses/115103036.
- 2. <u>https://www.youtube.com/watch?v=_tdI8QK31s4</u>
- 3. https://nptel.ac.in/courses/115105097
- 4. https://onlinecourses.nptel.ac.in/noc21_ma27/preview



1. Name of the De	epartment: Physics								
2. Course Name	Physics Practical-1	L	Т		Р				
3. Course Code	17030702	0	0		4				
4. Type of Cours	4. Type of Course (use tick mark) Core () DSE ($$) AEC () SEC () GE ()								
5. Pre-requisite	6.	Frequency	Even ()	Odd	Either	Every			
(if any)		(use tick	10 M 82 33	(1)	Sem ()	Sem ()			
		marks)							
7. Total Number	of Lectures, Tutoria	ls, Practical							
Lectures = 0		Tutorials =	0	Practical	= 52				
8. Course Descri	iption:								

Experiments include the Basic concepts of measurement of Planck's constant using LEDs, wavelength calculation using diffraction pattern, work function, IV characteristics and solving physics problems using programming.

9. Course Objectives:

The aim of this paper is that the student performs the experiment based on the description and calculate the results. Quantitatively and qualitatively evaluate the method and consequences of an experiment. Compare the result with the standard value wherever applicable and know how to calculate different type of errors. Communicate an experiment's procedure and results.

10. Course Outcomes (COs):

After successful completion of the course, students will be able to verify

1. The theoretical formulas by performing experiment

2. Demonstrate the practical application of properties of materials, effect that is how radiation can be converted into electric energy, PN diode characteristics.

3. Solving basic mathematical problems numerically.

11. List of Experiments

1. Basic Curve plotting in Matlab/Python.

2. Basic curve fitting in Matlab/Python

3. Data extrapolation in Matlab/Python.

4. To calculate the roots of transcendental equation in Matlab/Python.

5. To calculate the value of integral using trapezoidal rule.

6. To evaluate Scalar and Vector Product using MATLAB/Python

7. To evaluate Eigenvalue and eigenvectors of various matrices using MATLAB/Python.

8. Solving systems of linear equations in MATLAB/Python.

9. Solving a second order differential equation with variable coefficients in MATLAB/Python.

10. Computing Fourier Series with MATLAB/Python

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- 11. To plot trajectory of particle in two and three dimensions.
- 12. Book Recommended:
- 1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- 3. A Text Book of Practical Physics, Indu Prakash, and Ramakrishna, 11th Edition, □2011, KitabMahal, New Delhi.
- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- 5. A Byte of Python: free eBook: https://github.com/swaroopch/byte-of-python/releases/latest
- 6. Learn Python the Hard Way' by Zed A. Shaw

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1. Name of the De	partment: Phy	ysics					
2. Course Name	Classical Mech	hanics	L		Т		Р
3. Course Code	17030703		4		0		0
4. Type of Course	(use tick marl	k) Core	0	DSE $()$	AEC ()	SEC ()	GE ()
5. Pre-requisite (if any)		6. Freque (use tie	ency ck marks)	Even ()	Odd()	Either Sem ()	Every Sem ()
7. Total Number	of Lectures, Tu	itorials, P	ractical				1
Lectures = 52		T	utorials = 0	P	ractical =	• 0	
8. Course Descrip	tion:						
A study of classic Lagrangian and Har of these general prir	al mechanics niltonian metho nciples towards	including ods. The co specific p	different j ourse also p roblems	perspective laces empl	es of trad hasis on pr	itional N actical ap	ewtonian plication
9. Course Object	ives:						
The objectives of th	e course are to:						
 Demonstrate co Develop the equation 	nceptual under tions of motion	rstanding using diff	of the bas erent forma	ic princip lisms.	oles of cl	assical m	nechanics
3. Differentiate betw	veen the differen	nt formalis	sms and to i	dentify the	e type of p	roblem.	
4. Be familiar with t	he concepts of r	relativity					
10. Course Outcom	es (COs):						
After successful con	pletion of the c	course, stu	dents will b	e able to d	emonstrat	e the abili	ty to
1. Apply basic methomotion. Kepler's lav	ods of Newtonia vs of planetary r	an mechar motion	nics to probl	ems like T	wo-body	central for	ce field
2. Apply basic method	ods of Lagrangi	an formal	ism to simp	le mechan	ical proble	ms.	
3. Analyse canonical	transformation	is and und	erstand Ha	milton Jac	obi theory	′ .	
4. Understand Gener	al Theory of Re	elativity					
11. Unit wise detail	ed content						
Unit-1 Numbe	er of lectures =	14	Title of the	e unit: Ne	wtonian n	nechanics	
Single and many pa and energy. Applica laws of planetary r Rutherford scattering	rticle systems-C tion of Newtoni notion. Scatter g problem	Conservati an mechai ing in a	on laws of nics: Two-b central forc	linear mo ody centra ce field, s	mentum, a l force fiel cattering	ngular m ld motion. cross sect	omentum Kepler's tion, The
Unit - 2 Numbe	r of lectures =	14	Title of the	e unit: Lag	grangian f	formalisn	1
Constrains in motic Lagrangian equation principle; Lagrangia	on, generalised n of motion. n equation of m	l co-ordin Symmetry otion fron	ates, virtua and cyclin variationa	l work a c co-ordi l principle	nd D'Ale nates. Ha . Simple aj	mbert's p milton va oplication	orinciple. ariational s.
			/	fer	L	Iluh	D

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Unit - 3	Number of lectures = 13	Title of the unit: Hamiltonian formalism
Hamilton's Simple appl in Poisson t	equations of motion- from L lications. Canonical transformation of the provident of the pro	egendre transformations and the variational Principle. ations. Poisson brackets-Canonical equations of motion obi equations.
Unit - 4	Number of lectures = 11	Title of the unit: Relativistic mechanics
Relativistic acceleration	mechanics: Four-dimensiona . Lerentz co-variant form of e	al formulation- four-vectors, four-velocity and four- quation of motion.
12. Books F	Recommended	
 Classica Mechan 0750628 Introduc Educatio 	Il Mechanics: H. Goldstein, Pulics: L. D. Landau and E. M. L. 8969 Etion to Classical Mechanics: on. ISBN 978-0070966178	blisher – Pearson Education, ISBN-13 978-8131758915 ifshitz, Publisher - Butterworth-Heinemann. ISBN 978- R. G. Takwale and Puranik. Publisher - McGraw Hill
4. Introduc Educatio	tion to Classical Mechanics: Non. ISBN 978-0074603154	N. C. Rana and P. Joag. Publisher - McGraw Hill
13. Online l	inks	
1. <u>https://</u> 2. <u>https://</u>	/nptel.ac.in/courses/115106123 /ocw.mit.edu/courses/8-01sc-c	3 lassical-mechanics-fall-2016/

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2 Course Name	artme	nt: Physics						
2. Course Mame	Phy	sics Practical-2	L		Т		P	
3. Course Code	1703	30704	0		0		4	
4. Type of Course (use tick mark)		Core (√)		DSE ()		SEC ()	
5. Pre-requisite (if any)		6. Frequ (use t mark	iency ick s)	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of	Lectu	ires, Tutorials,	Practical					
Lectures = 0		Futorials = 0	Prac	tical = :	52			
7. Course Description	on:							
 Course Objective Understand laws of Understand and studies Content of the state of	es: motic udy of nenon	on and their appl f Kepler's laws of simple harmo	ication to to describ	various be the m	dyna iotio	umical situa n of planet	tions. ts and sat	ellite in
4. Study of Hamilton's 9. Course Outcomes	E Leas	t Action princip	le for a pa	rticle un	der t	he action o	f gravity	
After successful comp I.Visualize the simul	oletion ation, xperir	n of this course, and correlate t nents.	students v the theore	vill be at tical con	ole to ncep	ts and iden	ntify its p	oractical
applications through e 2. Understand laws of 3. Understand and stu circular orbit 4. Explain the phenom 5. Study of Hamilton's	idy of ienon	f Kepler's laws of simple harmo t Action princip	to describ onic motio le for a pa	n nticle un	dyna iotio der t	mical situa n of planet he action o	itions ts and sat	ellite in
applications through e 2. Understand laws of 3. Understand and stu circular orbit 4. Explain the phenom 5. Study of Hamilton's 10. List of Experimen	idy of ienon Least	of simple harmo	to descril onic motio le for a pa	n n nticle un	dyna iotio der t	mical situa n of planet he action o	itions ts and sat f gravity	ellite in

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- 4. Hamilton's Least Action principle for a particle under the action of gravity (Computational and Simulation)
- 5. Attractive Potential, energy, curves for a body under a central force (Computational)
- 6. Orbit period to obtain the time it takes to go from r min to r max in an orbit due to a force of the form arp (Simulation and Computational)
- 7. Action field of the Kepler/Coulomb problem (Simulation and Computational)
- 8. Keplerian orbits and principle (Simulation and Computational)
- 9. Roll pendulum (Simulation and Computational)
- 10. (The suspension point K1of a plane pendulum slides frictionless along the x-axis. The pendulum body K2 has the distance L from the suspension point. Both bodies have the same mass m1=m2=m and the connection between K1 and K2 is mass less)
- 11. To determine the height of a building using a Sextant.
- 12. To determine g and velocity for a freely falling body using Digital Timing Technique.
- To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
- 14. To determine the Young's Modulus of a Wire by Optical Lever Method.

Note: The list of the experiment given above should be considered as suggestive of the standard and available equipment. The faculty members are authorised to add or delete from this list whenever considered necessary.

12. Book Recommended

References for Laboratory Work:

1.Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House, ISBN-13 : 978-0423738902

2.Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd. ISBN: 9788131525203

3. Practical Physics, G. L. Squires, 2015, 4/e, Cambridge University Press, ISBN-9781139164498

4. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11/e, 2011, Kitab Mahal. ISBN-13 : 978-8122500844.

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2. Course Name	Quantum Chemistry & 7	Thermodynamics	T	Т	Т	,
3 Course Code	17030705	inerniouynamics				
4 Type of Course (1	use tick mark)	Core	4		SECO	CEO
Dre requisite			$DSE(\checkmark)$	ALC	SEC ()	GEO
(if ony)	INA	0. Frequency	Even()	$Odd(\checkmark)$	Either	Every
7 Total Number of	Lactures Tutorials Dra	(use tick marks)			Sem ()	Sem (
$\frac{1}{1} = \frac{1}{1} = \frac{1}$	Lectures, rutoriais, rra	Tutorials = Nil		Prostical -	- NH	1.
8. Course Description	on .	1 4101 1415 - 111		1 I actical -		
This course will enab	ble the graduate students to	understand the adva	ince concent	s of statistics	al thermod	vnamic
such as concept of dis	stribution, types of statistic	and various partitio	n functions.	It will also in	nclude info	rmatio
on quantum chemistr	y advancements, such as a	approximation metho	ds and chen	nical bonding	g.	matro
9. Course Objective	es		1			1923
The objectives of this	s course are:					1.000
1. To provide the f	irm foundation in statistic	al thermodynamics.				
2. To understand the	he chemistry of partition f	unction and entropy.				
3. To explain the a	dvancements in quantum	mechanics				
4. To understand the	he approximation methods	and chemical bondi	ng			6.44
10. Course Outcom	es (COs)	. 1				
1 A pply the know	ledge of statistical thermo	students will be able	e to:			
2 Correlate partiti	on functions and entrony y	with reference to che	areas	arium		
3. Explain the appr	coximation methods		inical equin	orium		
4. Demonstrate the	concepts with reference t	o chemical bonding				
11. Unit wise detaile	ed content	<u> </u>				
Unit-1	Number of lectures = 1	4 Title of the un	it: Statistic	al Thermod	vnamics I	
Maxwell - Boltzman velocity; law of equip partition function to content (v) work fund	n law of distribution of partition of energy; Partitio thermodynamic properties ction (vi) pressure (vii) he	energy and evaluation n function and its fac (I) internal energy (in at capacity at consta	on of averag torization, re i) entropy (ii nt volume.	ge velocity, elationship of ii) Gibb's fre Derivation o	root mear f atomic ar ee energy (of equation	i squar d mola (iv) hea of stat
for a monoatomic ide	al gas.					
Unit-2	Number of lectures = 1	2 Title of the un	it: Statistic:	al Thermod	ynamics I	I
Evaluation of Transl	ational partition function,	calculation of abso	lute entropy	of an ideal	monoator	nic gas
Vibrational, Rotation	al, & electronic partition	function of diatomic	molecules,	Derivation	of express	ions fo
due to transitional x	vibrational and rotational	motion of a molecu	r entropy, Gi	bbs free ene	rgy, work	
constant in terms of r	artition functions Free en	hergy function	ie. Chemica	requinoriun	n and equ	inoriun
Unit-3	Number of lectures = 1.	3 Title o	f the unit: (Juantum M	echanics-	I
Approximate method	s: First order time-indepe	endent perturbation t	heory for no	on-degenerat	te states, v	ariatio
principle. Application	on of first order perturbati	on and variation pri	nciple to ev	aluate grour	nd state of	heliun
atom. Applicability o	f perturbation theory to an	electron in a one dim	ensional box	under the in	fluence of	electri
field.				•		
Unit-4	Number of lectures = 1.	3 Title o	f the unit: (Quantum M	echanics-	II
Born-Oppenheimer a	pproximation, Valence bo	ond method to hydro	gen molecu	le ion and h	ydrogen m	nolecul
neir symmetric and a	inti-symmetric solution with	thout actual evaluation	on of various	integrals, er	nergy of m	olecula
MO theory to other	vistoms. HMO theory	ind to simple	e, Configura	ation Interac	tion. Exter	nsion o
12 Brief Description	of self-learning VE loop	ring component	s – etnene, bi	utadiene		
a. Diter Description	n or sen-rear ning/ E-lear	ning component				
10	Vas Ab	1	Ast			



- 1. http://epgp.inflibnet.ac.in/
- 2. https://youtu.be/bE7Z6Zkst1I
- 3. https://youtu.be/CBrsWPCp_rs
- 4. https://youtu.be/7ltAyG_m7jA
- 5. http://chemistry.umeche.maine.edu/Modeling/lcao.html.

13. Books Recommended

- 1. Glasstone, S. Theoretical Chemistry, ISBN: 9781446545461
- 2. Levine.Quantum Chemistry, ISBN: 978-9332558533
- 3. Pauling, Eyring and Wilson. Quantum Chemistry, ISBN: 978-0486648712
- 4. Nash, L.K. Introduction to Statistical Mechanics, ISBN: 978-0486449784
- 5. Donald. A. McQuarrie Statistical Mechanics-2011, ISBN: 978-8130918938
- 6. Frank L. Pilar, Elementary Quantum Chemistry 2001, ISBN: 9780486414645.

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1. Name of the Depa	rtment: Chemistry					
2. Course Name	Physical Chemis	try Practical – I	L	Т		P
3. Course Code	17030706		0	0		4
4. Type of Course (u	se tick mark)	Core ()	DSE (AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even ()	$Odd(\checkmark)$	Either	Every
(if any)		(use tick marks)			Sem ()	Sem ()
7. Total Number of	Lectures, Tutorials,	Practical				
Lectures = Nil		Tutorials = Nil	Pra	ctical = 52	hrs.	
8. Course Descriptio	n				1. A.	
This Course will enab	ole the students to lea	rn various conductomet	ric and pH m	etric titration	n technique	es. It also
nelps the students to	understand the surf	ace tension and adsorp	otion propert	ies of liquid	s. This co	urse wil
provide a platform to	develop methods for	the analysis of various	properties of	f liquids.	1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -	
9. Course Objective	s					
The objectives of this	course are:					
. To impart the kno	wledge of concept of	various conductometri	c titrations of			
To understand, the	surface tension and	adsorption of different	um constant			
. To explain knowle	edge of concept of pl	H meter	systems			
0. Course Outcome	eage of concept of pr	Timeter				
Jpon successful com	pletion of this course	the student will be abl	e to:			-
1. Describe various of	conductometric titrat	ions	c to.			
2. Explain the conce	pt of pH by using pH	l meter.				
3. Determine partitic	on coefficient and equ	uilibrium constant of va	rious systems	S		
4. Predict surface ter	nsion of liquids and a	dsorption of solids			1	
1. List of Experime	ents (At least seven e	experiments to be perfe	ormed by th	e student)		
1. Conductometry						
i. HCl vs NaOH	I titration.					
ii. Oxalic acid v	s NaOH titration.					
in. CH_3COOHV	s NaOH titration.	OU				
2. Surface tension						
Determine interfa	cial tension of two ir	nmiscible liquids.				
3. Adsorption						
To study the adso	orption of Oxalic acid	and Acetic acid on cha	rcoal.			
4. pH metric						
i. HCl vs NaOF	I titration.					
ii. Oxalic acid v	s NaOH titration.					
5. Distribution Law	s watch intration.					
i. To determine	partition coefficient	of benzoic acid betwee	n benzene an	d water		
ii. To determine	the partition coeffic	ient of Iodine between (Carbon tetrac	hloride and	water.	
12. Brief Description	of self-learning / E	-learning component				
1. https://youtu.be/E	00YzyJrKGg					
2. https://www.brita	nnica.com/science/s	urface-tension				
3. https://youtu.be/v	MOa7wrP3w0					
4. https://nptel.ac.in	/courses/108105063/	/pdf/L-08(SS)(IA&C)%	20((EE)NPT	EL).pdf		
b. https://www.thefi	reedictionary.com/dis	stribution+law				
13. Books Recomme	nded					
1. Khosla, B.D., V.C	C. Garg and A. Gulat	i.Senior Practical Physic	cal Chemistry	y (ISBN-13:	97881804	50792).
Y.	Job 3	Abo	Ad			

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2. Thawale, A. and P. Mathur. Experimental Physical Chemistry. (ISBN : 81-224-1336-6)

3. Vishwanatha, B. and P. S Raghav. Practical Physical Chemistry. (ISBN : 9788130920696)

4. Sindhu, P.S. Practical in Physical Chemistry. (ISBN-13: 978-1403929167)

to the



1. Name of the De	partment: Chemistry					
2 Course Name	Stereochemistry and Org	ganic Reaction		4	т	D
2. Course Maine	Mechanism				1	
3. Course Code	17030707			4	0	0
4. Type of Course	(use tick mark)	Core ()	DSE (✔)	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even ()	$Odd(\checkmark)$	Either	Every
(II any)	flaster Tatail D	(use tick marks)			Sem ()	Sem ()
6. Total Number of	of Lectures, Tutorials, Pr	acticals				
Lectures = 52		Tutorials = Nil	Practical =	= Nil		
Nowadays, chiral d the stereochemistry opportunity to ur configurations. Thi and will lay the fou 8. Course Objectiv The objectives of th 1. Provide the know importance in o 2. Understand diff 3. Explain different	rugs have become an integ y of drug molecules to ur inderstand the various as s course will also provide t undation on which further a ves his course are to: bwledge about understandi rganic synthesis. Ferent conformations and cont types of reactions with the weater of different name re-	ral part of the pharma iderstand their mech spects of stereoche he knowledge of the advanced topics can b ing stereochemistry, onfigurations of orga heir mechanisms.	aceutical ind anism of ac mistry, em mechanisms be built up. emphasizing nic moleculo	ustry, and it' tion. This co phasizing c of different g asymmetrices	s essential ourse prov onformatio chemical r c synthesis	to know ides the ons and eactions and its
Students will be ab 1. Identify and dif 2. Describe the ali 3. Develop capacit 4. Describe free ra	le to: ferentiate the conformation phatic and aromatic nucleo ty to explain aliphatic and dical substitution and elim	ns and configurations ophilic substitution re aromatic electrophilio ination reactions.	with their stactions. c substitutio	tereochemist	try	
10. Unit wise detai	iled content					
Unit-1	Number of lectures =	Title of the unit: S	tereochemi	stry		
Stangeigenegi	Classification Optical in					
two or more chiral Configuration nor (biphenyls, allenes, configurations, prop Cyclostereoisomer cyclohexenes, cyclo Asymmetric synthe	centers, nenclature: D, L and R,S spiranes), Optical isomeri perties of geometrical isom ism: Configurations, co ohexanones, halocyclohexa sis, Asymmetric Induction	configurations. Opti sm of nitrogenous conters. Axial and planar nformations and stanones, decalins, decal	ical isomeris ompounds, g chirality an- ability of alols and dec nd Felkin-A	sm in absence eometrical is d helicity. cyclohexane calones. hn model	ce of chiral somerism a	carbon and E, Z & di),
Unit-2	Number of lectures = 13	Title of the unit: Substitution (Reac	Aliphatic tion Mecha	and Arom nisms)	atic Nucle	eophilic
Aliphatic Nucleop mechanism. The ne by pi and sigma be aliphatic trigonal an leaving group and r Aromatic Nucleop structure, leaving gr Unit-3	hilic Substitution: The S_N sighbouring group mechan onds, Classical non classi id vinylic carbon. Effect on eaction medium. Ambiden hilicSubstitution: S_NAr , S_N roup and nucleophile. The Number of lectures = 13	$(2, S_N 1 \text{ and } S_N \text{i mech})$ ism (anchimeric assical & phenonium ca the reactivity due to the reactivity due to the nucleophiles and su N1, benzyne and S _{RN} 1 von Richter, Somme Title of the unit: Substitution	anisms, mix istance). Nei tions, Nucle - substrate s ibstrates reg mechanism let-Hauser, a Aliphatic	ed $S_N 1 \& S_N$ ighbouring geophilic substructure, atta ioselectivity s. Reactivity and Smiles r and Aroma	2 mechani group partid stitution at cking nucl effect of s earrangem atic Electr	sm SET cipation allylic, eophile, ubstrate ents, rophilic
V	Jeep	Ab	r	Ash	•	

to the fit.



Alphatic Electrophilic Substitution: Bimolecular mechanisms - S_E2 and S_{E1} . The S_{E1}	mechanism,
lectrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving gr	oup and the
olvent polarity on the reactivity.	
romatic Electrophilic Substitution: The arenium ion, mechanism, orientation and reactivity, en	nergy profile
iagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative	treatment of
reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeir reaction, Gattermann-Koch reaction,	
echmann reaction, Houben – Hoesch reaction, Fries rearrangement.	
nit-4 Number of lectures = Title of the unit: Free Radical Substitution and	Elimination
13 Reactions	
ree Radical Reactions: Types of free radical reactions free radical substitution mechanisms	Mechanisms
an aromatic substrate neighbouring group assistance. Reactivity for alighbatic and aromatic su	instrates at a
ridgehead Reactivity in the attacking radicals Effect of solvents on reactivity. Allylichalogen	ation (NIRS)
xidation of aldehydes to acids, auto-oxidation, coupling of alkynes and arylation of aromatic co	mounds by
azonium salts Sandmever reaction Free radical rearrangement Hunsdiecker reaction Kol	he reaction
vdroxylation of aromatics by Fenton's reagent	oe reaction,
limination Reactions: The E ₂ E ₁ E ₂ mechanisms Orientation of the double bond Effects	of substrata
ructure attacking base leaving group and medium on reactivity. Mechanism and orientation	in pyrolytic
iminations	in pyrorytic
Prist Description of call boundary (Education of Education of Educatio	
2. Brief Description of self-learning / E-learning component	
. http://www.colby.edu/chemistry/CH241F/Chapter%204.pdf	
. https://onlinecourses.nptel.ac.in/noc17_cy11/announcements	
. http://nptel.ac.in/courses/104105086/	
. http://ocw.uci.edu/courses/chem_201_organic_reactions_mechanisms_i.html	
. https://swayam.gov.in/courses/189-organic-chemistry-iii-reaction-mechanisms-2	
6. https://faculty.chemistry.harvard.edu/myers/pages/chem-115-handouts	
. http://www.cureffi.org/tag/chem-20/	
https://archive.org/details/EvansD.A.HarvardsAdvancedOrganicChemistry2003/page/n51	
https://www.masterorganicchemistry.com/2013/07/30/free-radical-reactions	
3. Books Recommended	
Stereochemistry of carbon compounds, E.L.Eliel and S.H. Wilen, Wiley, ISBN: 9788126515	707
Stereochemistry of organic compounds- Principles and Applications, D. Nasipuri, NEW	AGE: Third
edition (2018), ISBN-13: 978-8122430295	
Advanced Organic Chemistry - Jerry March, John Wiley & Sons Inc; 3rd edition, ISBN:978-0	471854722.
Advanced Organic Chemistry, Part A: Structure and Mechanisms, F.A. Carey, R.J. Sunberg	2. Publisher:
Springer; 5th edition (2008), ISBN-13: 978-0387683461	
Highlights of Organic Chemistry, W.J. L. Nobel; An Advanced Text Book, CRC Press; 1 edi	tion (1974).
ISBN-13: 978-0824762100	
Stereochemistry conformation and Mechanism - P. S. Kalsi, New Age Publishers: Tentl	h edition (1
January 2019), ISBN-13: 978-9387788329	
A Guide Book to Mechanism in Organic Chemistry, P.Sykes, BH Kishan, earson Education	n: 1 edition
(2013), ISBN-13: 978-8131793558	,
Structure and Mechanism in Organic Chemistry, C. K. Ingold, CBS: 2 edition (2000) ISI	3N-13: 978-
8123909752	
Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice Hall: 6th edition (January 27, 19	992), ISBN-
13: 978-0136436690	-,,
). Reaction Mechanism in Organic Chemistry, S. M. Mukherii and S. P. Singh, Trinity, Macmilla	n Publishers
India (1984), ISBN-13: 978-0333904619	
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1. Name of the Dep	artment: Chemistry	· · · · · · · · · · · · · · · · · · ·				
2. Course Name	Organic Chemistry	Practical - I	L	Т		Р
3. Course Code	17030708		0	0		4
4. Type of Course (use tick mark)	Core ()	DSE (√)	AEC ()	SEC ()	GE ()
5. Pre-requisite	NA	6. Frequency	Even ()	(\mathbf{A}) bbO	Either	Every
(if any)		(use tick marks)			Sem ()	Sem ()
7. Total Number of	Lectures, Tutorials, P	racticals				
Lectures = Nil	7	Tutorials = Nil	P	ractical = 5	2 hrs.	
8. Course Descripti	on					
This Course will intr	oduce the students to sy	nthesize the organic	compounds	and enable th	hem to dev	elon and
practice independent	experimental skills. Stud	dents will learn stered	chemical a	spects (geon	netrical iso	mers and
stereoisomers) and d	ifferent reactive intermed	diates formation durin	ng the synthe	esis of organ	ic compou	nds. This
course will also give	a platform to develop d	ifferent methods to sy	ynthesize or	ganic compo	unds.	
9. Course Objective	9 S					
The objectives of thi	s course are:					
1. To introduce the	e standard techniques us	ed for organic synthe	sis			
2. To learn conder	sation and carbene addi	tion reactions				
3. To understand r	ucleophilic aromatic/ali	phatic substitution re	actions			
4. To understand r	earrangement reactions	involving carbocation	ns and carba	nions		
5. To learn the har	dling of organic chemic	als safely and describ	be their pote	ntial dangers		
10. Course Outcom	es (COs)					
Upon successful con	pletion of this course, th	he students will be ab	ole to:	Y		22000
1. Perform various	organic synthesis by util	lizing various synthet	tic technique	es		
2. Design different	organic synthetic metho	ods				
3. Describe disposa	Il techniques and laborat	ory emergency proce	dures			6.6.1.2.
4. Apply purification	on techniques for the pur	ification of organic c	compounds			
11. List of Experime	ents (At least seven exp	eriments to be perfe	ormed by th	e student)		
Preparations involvir	ng stereochemical aspect	ts (geometrical isome	ers and stered	oisomers) an	d different	reactive
intermediates:						
(a) Condensati	on reaction,					
(b) Carbene ad	dition,					
(c) Nucleophil	ic aromatic/aliphatic sub	stitution reaction				
(d) Rearrangen	nent reactions involving	carbocations and car	banions			
Note: Overall at lea	st 10 experiments shou	ld be performed inc	cluding one	from each c	ategory.	
12. Brief Descriptio	n of self-learning / E-le	arning component				
I. https://www.you	tube.com/watch?v=fbNf	_guvK_0				
2. https://www.you	tube.com/watch?v=6ML	DPA1msHF4				
5. https://www.you	tube.com/watch?v=Wuc	p2w1u3-U				
13. BOOKS Recomme		0 1 1 0 1 5 1	DOGU			
1. Chapman and Ha	in, Principles of Organi	ic Synthesis 2nd Ed.	., R.O.C.No	rman,1978.	(ISBN-13	: 978-
04/02031/4)	Prostical Complexit	Organia Charrist	D	D 1	1 5	
2. Stephane Caron,	Tractical Synthetic (Organic Chemistry:	Reactions,	Principles,	and Te	chniques
3 John Leonard	Barry Lygo Com	Proctor Advanced	Dreatiant	Organia	Thornist	(ICD) I
9781138404145)	Darry Lygo, Garry	riocter, Advanced	Fractical	Organic C	memistry,	(ISBN
4 Nicolas Bogliotti	Roha Moumné Mult	i sten organic sunth	necic A mi	ide through	ovnorim	nto Dec
2017 (ISBN: 978.	-3-527-34065-1)	a step organic synti	icsis, A gui	de dirough	experime	ints, Dec
5. Brian S. Furniss	Antony I Hannaford Pet	tr W G Smith Austin	R Tatchell	Vogels tex	rt book of	
practical organic	chemistry, 5 th addition (ISBN : 97881775894	573)	, vogets ter	A DOOK OI	
protectul organie	uddition), or uddition. (,,,,,			
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1. Name of the l	Department: N	Iathematics				
2. Course	Metric	L	1	Γ]	P
Name	Spaces				1	
3. Course	17030709	4	()		0
Code						
4. Type of Cour	se (use tick	Core ()	DSE (AEC ()	SEC ()	OE ()
mark)						
5. Pre-		6. Frequency	Even ()	Odd (Either	Every
requisite		(use tick			Sem ()	Sem ()
(if any)		marks)				
7. Total Number	r of Lectures,	Tutorials, Practical			1	
Lectures = 52		Tutorials = 0	Pra	ctical = 0		
8. Course Descr	iption:					
This course includ	es basics of me	etric spaces, its proper	ties, open ar	nd closed se	ts with res	spect to
metric defined, see	quences and the	eir convergence in met	tric spaces, a	abstract pro	perties: co	nnected
and compactness,	Heine-Borel th	eorem, homeomorphis	sm and isom	netry of met	ric spaces	
0 Course Ohio						<u></u>
The main objective	e of this course	is to familiariza stud	anto with the	hasis noti-	no of mot	nia
and and and and	tond it in		all's with the	basic notic	ons of meti	IC
spaces and unders	tand it in a mor	e general setting as an	abstraction	to real anal	lysis.	
10. Course Outer	mes (Cos).					
To: Course Outed		. 1 . 1 11 1 11 .				
On completion of	the course the	students shall be able t	0:			
1. To identify	metric spaces,	, and analyze its prope	rties in com	parison to r	eal valued	l i
function sp	aces.					
2. To underst	and the concep	ts of sequence and the	ir converge	nce in metri	ic spaces.	
3. To know th	he basic concep	ots of connectedness an	nd compactr	ness.		
4. To apply th	ne concept of n	netric space on various	functions t	o describe r	nany prop	erties.
11 TI-: 4 !						
II. Unit wise deta	alled content	- 12 T:41 - C41 -	· · · · ·			
Definition and av	omplag of mar	= 13 Title of the un	nit: Introdu	ction to M	etric Space	es
Definition and ex	amples of me	tric spaces, Bounded	and unboun	nded metric	c spaces,	Distance
between sets, Diar	neter of a set, (Jpen and closed balls,	Interior por	ints and inte	erior of a s	et, Open
set, Neighbourhoo	d of a point, L	imit point of a set, Clo	sure of a se	t, Closed se	et, Bounda	ry points
and boundary of a	set, Exterior pe	oints and exterior of a	set, Subspace	e of a metr	ic space.	
Unit – 2 Num	ber of lectures	= 13 Title of the un	nit: Sequen	ces in Metr	ric Spaces	
Sequences and su	b-sequences in	a metric space, Conv	regent and	Cauchy see	quences, (Complete
metric spaces, Re	elation between	n completeness and o	closedness,	Cantor int	ersection	theorem,
Completion theore	em, Dense sets	, Separable spaces, N	owhere den	ise sets, Ca	tegories a	nd Baire
Category theorem.						
Unit – 3 Numl	ber of lectures	= 13 Title of the un	nit: Connec	tedness and	d Compac	tness
Cover of a metric	space, Compa	ct metric spaces, Com	pact sets an	d their crite	erion. Pror	perties of
compact sets. Rel	ation between	compactness, complet	teness and o	losedness	Finite inte	ersection
property Bolzano	-Weierstrass	property Sequential	compactne	Totally	hounded	chaoas
Sonoroted sets. Co	nnosted and di	property, Sequenciar	Dreasent	ss, rotany	bounded	spaces,
Separated sets, Co	infected and dis	sconnected metric space	les, Properti	les of conne	ected sets.	
Unit – 4 Numl	per of lectures	= 13 Title of the up	nit: Functio	ns on Met	ic Snaces	
aM		in the of the un	into runctio	no on mieti	ic spaces	
101	had	ile.	10		1.1	
1.0.	me		Val	cs.	Lolate	State of the second
				60		



Continuous functions, Characterizations of continuous functions, Continuous functions on compact and connected spaces, Uniform continuous functions, Homeomorphism and isometry.

12. Brief Description of self-learning / E-learning component

- 1. https://www.youtube.com/watch?v=Af03P1xVNSs
- 2. <u>https://www.youtube.com/watch?v=Ry07_mO-iac</u>
- 3. <u>https://www.youtube.com/watch?v=1DghwIIir-U</u>

13. Books Recommended:

- 1. Q. H. Ansari: Metric Spaces: Including Fixed Point Theory and Set-Valued Maps, NarosaPublishing House New Delhi. 2010.
- 2. E. T. Copson: Metric Spaces, Cambridge University Press, 1968.
- 3. Mícheál O'Searcoid : Metric Spaces, Springer, 2007.
- 4. S. Kumaresan: Topology of Metric Spaces (2nd ed.), Narosa Publishing House, 2011.

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1. Name of the Dep	artment: Mather	matics				
2. Course Name	Functional	L .	Γ	1		P
	Analysis					
3. Course Code	17030710	4	0			0
4. Type of Course	(use tick mark)	Core ()	DSE ()	AEC ()	SEC	OE ()
5. Pre-requisite		6. Frequency	Even ()	Odd	Either	Every
(if any)		(use tick		(1)	Sem	Sem ()
		marks)			0	
7. Total Number of	f Lectures, Tutor	ials, Practical				
Lectures = 52		Tutorials = 0	Pra	ctical = 0		
8. Course Descript	ion:				a la serie de la s	
 in their applied ma concerned with the st to the basic concepts 9. Course Objective 9. Course Objective The objective of the spaces, especially lin spaces. In particular uniform boundedness 10. Course Outcome On completion of the 1. To understand th 2. To analyze the p defined. 3. To apply the the applied mathema 4. To discuss many 	and theorems of finance of the spaces of finance of the spaces of finance of the spaces of finance of the space of the spa	es. Functional ana functions. This cou unctional analysis a y linear mappings real-valued mappin heorems in functi- heorems will be co ts shall be able: e of normed linear ar operator with the paces and Hilbert gral equations and hs on the open ma	alysis is the rrse is inten- and its appli- defined on ngs) on L ^P , onal analys vered spaces and l e dimension spaces for differential pping, closs	be branch ded to intr ications. Banach sp C[0,1] an sis, namel Banach spa n of the spa solving m equations ed graph a	of mat oduce the paces and d some s y, Hahn aces. ace on w any prol , nd Hahn	hematics e student d Hilbert sequence -Banach, hich it is blems of
theorems.						
11. Unit wise detaile	d content					
Unit – I Number	01 lectures = 13	Title of the unit	: Normed]	Linear Spa	aces	1
Normed linear space Completion of a norm $l^{\infty}, \mathbb{R}^n, \mathbb{C}^n$ and $C[a,b]$.	s, Metric on nor ned space, Banach Incomplete norm	med linear spaces, spaces, subspace of ed spaces.	, Holder's of a Banach	and Mink space, Co	owski in mpletene	equality, ess of l^p ,
Unit – 2 Number	of lectures = 13	Title of the unit Spaces	: Operator	s on Norn	ned Line	ar
Finite dimensional a Bounded and continu on finite dimensional	normed spaces, I nous linear operate spaces, Normed s	Equivalent norms, ors, Linear function pace of operators,	Compactn onals, Linea Dual spaces	r operator	finite dir s and fur	mension, nctionals
Unit – 3 Number	of lectures = 13	Title of the unit	: Hilbert s	paces		
Inner product space inequality, Total ort spaces, Hilbert adjoin	es, Hilbert space honormal sets an t operators, Self-a	es,Orthogonal cor d sequences, Rep djoint, unitary and	nplements resentation normal ope	and direct of function erators.	et sums, onals on	Bessel Hilbert
Multel	Analik	. \.)/	c.s.l.	exe	



Uni	it – 4	Number of lectures = 13 Title of the unit: Fundamental theorems for Normed and Banach Spaces
Hal Ref of s	nn-Banao lexive s equence	ch theorem, Hahn-Banach theorem for complex vector spaces and normed spaces, paces, Uniform boundedness theorem, Strong and weak convergence, Convergence of operators and functionals, Open mapping theorem, Closed graph theorem.
12.	Brief D	escription of self-learning / E-learning component
1. 2. 3.	http://w https://v 2 https://v 10	www.youtube.com/watch?v=5BfJHZRgoEA&list=PL5022A32B9BCFE3E4&index= www.youtube.com/watch?v=pd3jUcTA5pA&list=PL5022A32B9BCFE3E4&index=
13.	Books H	Recommended
1.	E. Krey	szig: Introductory Functional Analysis with Applications, Wiley India, 2007.
2.	R. Bhat	tia, Notes on Functional Analysis, Hindustan Book Agency, India, 2009.
3.	G. Bacl	hman and L. Narici, Functional Analysis, Dover Publication, N.Y. 2000.
4.	A. H. S Applica	Siddiqi, Khalil Ahmad and P. Manchanda, Introduction to Functional Analysis with ations, Anshan Ltd., 2007.
5.	M. Sch 2002.	nechter, Principles of Functional Analysis(2 nd ed.),American Mathematical Society,

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1. N:	ame of the I	Department: Mathe	ematics				
2. C	ourse	Advanced		×			
· N:	ame	Differential	L	(Γ		P
		Equations					
3. C	ourse	17030711			0		
C	ode		• 4	1	0		0
4. Ty	ype of Cour	se (use tick mark)	Core ()	DSE	AEC ()	SEC	OE ()
				(1)		0	
E D				(*)			
5. PI	re-		6. Frequency	Even ()	Odd	Either	Every
re	equisite		(use tick marks)		1.*	Sem	Sem ()
	ii any)					0	
/. 10	otal Number	r of Lectures, 1 uto	rials, Practical	D			
Lectu	res = 52	• • •	Tutorials = 0	Pra	ctical = 0		
8. Co	ourse Descr	iption:		0.000			
Funda	amental exist	tence and uniquenes	ss theorem of solution	of ODEs	s, Depend	ence of s	solutions
on ini	itial conditio	ons, Existence and	uniqueness theorem	tor highe	er order, I	_inear sy	stem of
homog	geneous and	non-homogeneous	equations, Series sol	lution abo	ut an ordi	nary poi	nt and a
regula	ar sıngular	point, Frobenius m	nethod, Lagendre, B	Bessel, La	aguerre, I	Hernite,	Gauss
hyperg	geometric ec	juations and their ge	eneral solutions. Recu	rrence rela	ations, Ro	drigue's	formula,
Ortho	gonality pro	perties					
9. Co	ourse Obje	ctives:					
This c	course aims t	o prepare students v	with a deep understand	ing of diff	ferential ec	quations,	
resear	ch oriented a	attitude and skill of a	application of differen	tial equati	ons, comp	utational	tools
and te	chniques in	formulation and solu	ution of real world pro	blems. It	is specially	y designe	ed to
prepar	re students fo	or a successful caree	r in academic instituti	ion, resear	ch instituti	ion and	
indust	try.						
10. Co	ourse Outco	omes (COs):					1
On co	mpletion of	the course the stude	nts shall be able to:				
1 7						1	
1.1	to solve sec	cond order and hig	her order linear diff	erential e	quations a	ind to de	etermine
t	undamental	solutions and discus	s independence soluti	ons using	the Wrons	skian.	
2. 1	l'o understan	d the basic concept	of existence and uniqu	ieness of t	he differen	ntial equa	ations.
3. 1	Fo know abo	out the series solution	ons of various differen	ntial equat	tions and t	o discus	s special
f	functions.						\$
4. 0	Create and an	nalyze mathematica	l models using higher	order dif	ferential e	quations	to solve
a	application p	roblems such as har	monic oscillators and	circuits.			
11. Ur	nit wise deta	iled content					
Unit -	-1 Numl	ber of lectures =	Title of the unit: Lin	ear diffe	rential equ	ations	
	15						
Linger	differenti 1	Convertioner C (1)					
Linear	r differential	equations of nth	order, fundamental s	ets of sol	utions, W	ronskian	, Abel's
identit	ty, Theorems	s on linear depende	nce of solutions, Adj	oint and s	self-adjoin	t linear o	operator,
Green	s theorem, A	Adjoint equations, V	ariation of parameters	s, zeros of	solutions.		
Unit -	-2 Numbe	er of lectures = 7	Fitle of the unit: Exis	tence- Un	iqueness	of solutio	ons for
	10		DDEs		queness	Solution	
E I				0.07-	-		
Funda	imental exist	ence and uniquenes	s theorem of solution	of ODEs	, Depende	ence of s	olutions
on init	tial condition	ns, Existence and ur	iqueness theorem for	higher or	der, Eigen	nvalue pi	oblems,
Sturm	-Liouville pi	roblems, Orthogona	lity of eigenfunctions.	, Eigenfun	iction expa	ansion in	a series
of orth	nonormal fur	ictions, Green's fund	ction method.				
	• • ^	· 0 0.1	X	~ /	. /	· · · · · · · · · · · ·	
	W	Implete	i lan	/	c/.	4	
il	gru.		for		C. S. Kal	te	•
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Unit –	3 Number of lectures =	Title of the unit: Series Solution of ODEs						
	15							
Power equation ordinar Hernite	series solution of linear differ ns, Classification into regula y point and a regular singu- e, Gauss hypergeometric equ	rential equations, Ordinary and singular points of differential ar and irregular singular points, Series solution about an alar point, Frobenius method, Lagendre, Bessel, Laguerre, uations and their general solutions. Generating function,						
Recurr	ence relations, Rodrigue's for	mula, Orthogonality properties.						
Unit –	Unit -4 Number of lectures = Title of the unit: Stability analysis of solution to ODEs 12							
Linear	system of homogeneous and	non-homogeneous equations (matrix method), Linear and						
Non-li	hear autonomous system of e	equations, Phase plane, Critical points, Stability for linear						
system	s, Principle of linearized stabi	lity, Stability for autonomous systems, Lyapunov functions,						
Plane a	utonomous systems, Periodic	solutions of plane autonomous systems.						
12. Bri	ef Description of self-learnin	ng / E-learning component						
1. http	://nptel.ac.in/courses/1111080	081/						
2. http lect	s://ocw.mit.edu/courses/mathoures/	ematics/18-03-differential-equations-spring-2010/video-						
13. Bo	oks Recommended							
1. G. Mo	F. Simmons, Differential Equa Graw Hill Education, India, 2	ations with Applications and Historical Notes (2 nd ed.), 2017.						
2. M. Lo	S.P. Eastham, Theory of Ordi ndon, Florence, Kentucky, U.	nary Differential Equations, Van Nostrand Reinhold S.A., 1970.						
3. S.I	. Ross, Differential Equation	s (3 rd ed.), Wiley,, 2007.						
4. E. Pe	Rainville, P. Bedient and arson, 2016.	R. Bedient, Elementary Differential Equations (8 th ed.),						
5. A. Pa	C. King, J. Billingham and S.I. rtial(1 st ed.),, Cambridge Univ	R. Otto, Differential Equations:Linear, Nonlinear, Ordinary, versity Press, New York, 2003.						

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	par emener rinaer	nema	tics					
2. Course Name	Advanced		L		Τ		P	
	Differential							
	Equations Lab							
		3.0						
3. Course Code	17030712		0		0		4	
4. Type of Course	(use tick	Co	re ()	DSE (AEC ()	SEC	OE ()	
mark)				(-)		0		
7 D 1 U								
5. Pre-requisite		6.	Frequency	Even ()	Odd (🖌	Either	Every	
(II any)			(use tick			Sem	Sem ()	
			marks)			0		
7 Total Number	of Lactures Tut	orial	Drastical					
Lectures = 0	Di Lectures, rut	onai	S, Fractical Tutorials =	0	Practical =	52		
Lectures			Tutoriais	U	1 Tactical -	54		
8. Course Descrip	tion:							
This course is desi	gned to emphasi	ize tl	he knowledg	e of differe	ential equat	ions. Em	phasis is	
placed on different	forms of linear	and	non-linear o	lifferential	equations.	Upon con	mpletion.	
students should be a	ble to write the p	rogra	ams in MATI	AB and ot	her software		1	
9. Course Object	ives:							
On completion of th	e course the stud	ents s	shall be able	to:				
1 Give an account	t of basic concon	toon	dafinitions	for differen	tial investige			
2. Use methods f	or obtaining ever	ts and	utions of lin	for unteren	tial equation	IS.		
differential equ	ations	1 501	utions of min	ear nomoge	ineous and	non-nome	ogeneous	
3 Describe some	simple numeric:	al so	lution techni	aues and h	e familiar 1	with math	omatical	
software for dif	forantial aquation	15	intion teenin	ques and 0	c lammai v	vitii illati	lematical	
Solt it all all	IEIEIIIAI EUIAIIOI	10.						
4. Use elementary	methods for line	ar sv	stems of diffe	erential equ	ations			
4. Use elementary 10. Course Outcom	methods for line	ar sy	stems of diffe	erential equ	ations.			
4. Use elementary 10. Course Outcom	methods for line ies (COs):	ar sy	stems of diffe	erential equ	ations.			
4. Use elementary 10. Course Outcom After completing th	methods for line (COs): le course, studen	ear sy ats ar	stems of diffe	be able t	ations.	erential e	equations	
4. Use elementary 10. Course Outcom After completing the analytically.	methods for line (COs): ne course, studen	ar sy	stems of diffe	o be able t	ations. o solve diff	erential e	equations	
 Use elementary Course Outcom After completing the analytically. List of Practica 	referitial equation methods for line res (COs): re course, studen l's (using any on	ar sy its ar	stems of diffe e expected to m C++, MA	be able t TLAB)	ations.	erential e	equations	
4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica	referitial equation methods for line res (COs): ne course, studen l's (using any on	ear sy ats ar ae fro	stems of diffe e expected to m C++, MA	b be able t TLAB)	ations.	erential c	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve different of the solve difference diffe	referitial equation methods for line nes (COs): ne course, studen l's (using any on cerential equation	ar sy ats ar ae fro s by	stems of diffe e expected to m C++, MA basic method	b be able t TLAB)	ations. o solve diff without initi	èrential c al conditi	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diff 2. To solve firs 	referitial equation methods for line nes (COs): ne course, studen l's (using any on erential equation t order Bernoulli	ear sy ts ar ne fro s by equa	stems of diffe e expected to m C++, MA basic method tions.	b be able t TLAB) s with and	ations. o solve diff without initi	erential e	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diff 2. To solve firs 3. To solve non 	referential equation methods for line nes (COs): ne course, studen l's (using any on ferential equation t order Bernoulli i-linear differentia	ar sy ts ar ne fro s by equa al equ	stems of diffe e expected to m C++, MA basic method tions. uations with	b be able t TLAB) s with and v	ations. o solve diff without initi itions.	èrential e al conditi	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diff 2. To solve firs 3. To solve non 4. To solve sector 	referential equation methods for line res (COs): re course, studen l's (using any on ferential equation t order Bernoulli i-linear differentia ond order ODE w	equa al equa al equa	e expected to m C++, MA basic method tions. uations with nitial condition	b be able t TLAB) s with and y initial conditions.	ations, o solve diff without initi itions.	èrential d	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diff 2. To solve firs 3. To solve firs 3. To solve non 4. To solve seed 5. To solve <i>n</i>th 6. To solve <i>n</i> 	referential equation methods for line nes (COs): ne course, studen l's (using any on referential equation t order Bernoulli i-linear differentia ond order ODE w order non-homog	ar sy ats ar ae fro s by equa al equa vith in geneo	e expected to m C++, MA basic method tions. uations with nitial condition ous linear equ	b be able t TLAB) s with and y initial conditions.	ations. o solve diff without initi itions.	erential e	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diff 2. To solve first 3. To solve first 3. To solve none 4. To solve sectors 5. To solve <i>n</i>th 6. To solve eiged 7. To solve State 	referential equation methods for line nes (COs): ne course, studen l's (using any on ferential equation t order Bernoulli n-linear differentia ond order ODE w order non-homogenvalue problems rm Liouvilla	ar sy ts ar he fro s by equa al equa vith in geneo	stems of diffe e expected to m C++, MA basic method tions. uations with nitial condition bus linear equ	b be able t TLAB) s with and v initial conditions.	ations. o solve diff without initi itions.	erential e	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diff 2. To solve first 3. To solve first 3. To solve non 4. To solve sect 5. To solve non 4. To solve sect 5. To solve sect 5. To solve sect 6. To solve set 7. To solve Stu 8. To find non 	referential equation methods for line res (COs): me course, studen l's (using any on ferential equation t order Bernoulli n-linear differentia ond order ODE w order non-homogenvalue problems rm-Liouville problems	ar sy ats ar te fro s by equa al equa al equa vith in genecos	stems of differences e expected to m C++, MA basic method tions. uations with initial condition ous linear equals.	b be able t TLAB) s with and y initial conditions.	ations. o solve diff without initi itions.	èrential e al conditi	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diffind the solve first of solve first of solve first of solve none 4. To solve seed 5. To solve not first of solve seed 5. To solve seed 5. To solve seed 5. To solve seed 5. To solve set first of solve first of solve seed 5. To solve seed	referential equation methods for line nes (COs): ne course, studen l's (using any on ferential equation t order Bernoulli n-linear differentia ond order ODE w order non-homogenvalue problems rm-Liouville problems rm-Liouville problems vapunov Export	ar sy ats ar ae fro s by equa al equa vith in geneo s. blems s of li	stems of different e expected to m C++, MA basic method tions. uations with nitial condition ous linear equise inear different	be able t TLAB) s with and y initial conditions. tial equations.	ations. o solve diff without initi itions.	erential e	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diff 2. To solve first 3. To solve first 3. To solve non 4. To solve sector 5. To solve non 4. To solve sector 5. To solve sector 5. To solve sector 5. To solve sector 6. To solve sector 7. To solve Stute 8. To find power 9. To plot the Logonary 	re-Liouville problems rm-Liouville problems ryapunov Expone	ar sy ats ar he fro s by equa al equa al equa vith in geneo s. blems s of li ent of	stems of diffe e expected to m C++, MA basic method tions. uations with nitial condition ous linear equise inear different autonomous	b be able t TLAB) s with and v initial conditions. tial equations. tial equations.	ations. o solve diff without initi itions.	erential e	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diff 2. To solve diff 2. To solve firs 3. To solve firs 3. To solve non 4. To solve second 5. To solve non 4. To solve second 5. To solve second 5. To solve second 6. To solve second 7. To solve Stute 8. To find power 9. To plot the Logonal product of the second 	referential equation methods for line res (COs): me course, studen l's (using any on ferential equation t order Bernoulli i-linear differentia ond order ODE w order non-homogenvalue problems rm-Liouville problems	ar sy ats ar he fro s by equa al equa al equa blems s of li ent of n of a	stems of diffe e expected to m C++, MA basic method tions. uations with nitial condition ous linear equise inear different autonomous su	b be able t TLAB) s with and y initial conditions. lations. tial equations systems. ystems.	ations. o solve diff without initi itions. ns.	èrential e	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diffind the solve firms 3. To solve firms 3. To solve firms 3. To solve not firms 4. To solve sect for solve solve firms 5. To solve not firms 6. To solve sect for solve eiged 7. To solve Stute 8. To find power 9. To plot the Leged 10. To draw the period of the solve solve solve for the solve sol	re-Liouville prolems ryapunov Expone has plot diagram	ar sy ats ar ats ar a fro s by equa al equa vith in geneo s. blems s of li ent of a a g / E	stems of different e expected to m C++, MA basic method tions. uations with nitial condition ous linear equise inear different autonomous s c-learning co	b be able t TLAB) s with and y initial conditions. tial equations. tial equations. ystems. ystems. mponent	ations. o solve diff without initi itions.	èrential (al conditi	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diff 2. To solve firs 3. To solve firs 3. To solve non 4. To solve seed 5. To solve non 4. To solve seed 5. To solve eige 7. To solve Stu 8. To find powe 9. To plot the L 10. To draw th p 	re-Liouville problems yapunov Expone hase plot diagram	ar sy ats ar a fro s by equa al equa al equa vith in geneco s. blems s of li ent of n of a g / E	stems of diffe e expected to m C++, MA basic method tions. uations with nitial condition bus linear equise inear different autonomous sutonomous s -learning co	b be able t TLAB) s with and v initial conditions. tial equations systems. ystems. mponent	ations. o solve diff without initi itions.	erential e	equations	
 4. Use elementary 10. Course Outcom After completing the analytically. 11. List of Practica 1. To solve diffind the solve first of the solve first of the solve first of the solve sectors. To solve nore first of the solve sectors. To solve nore first of the solve sectors. To solve sectors. T	re-Liouville prolems rm-Liouville prolems rm-Liouville prolems rm-Displace in the second second re-linear differential re-linear differential rm-Liouville prolems rm-Liouville p	ar sy ats ar ats ar a fro s by equa al equa al equa vith in geneco s. blems s of li ent of an of a ag / E	stems of different e expected to m C++, MA basic method tions. uations with initial condition ous linear equises inear different autonomous sintent of the inear different autonomous sintent of the inear of the the the inear different of the the inear different of the the inear different of the the inear different of the the the inear different of the the the the inear different of the the the the inear different of the the the the the the inear different of the	b be able t TLAB) s with and y initial conditions. tial equations. tial equations. ystems. ystems.	ations. o solve diff without initi itions.	erential al conditi	equations	



- 1. https://www.mathworks.com/help/symbolic/solve-a-single-differential-equation.html
- 2. https://in.mathworks.com/help/symbolic/solve-a-system-of-differential-equations.html
- 3. https://www.mathworks.com/help/matlab/math/choose-an-ode-solver.html
- 4. http://www.math.tamu.edu/undergraduate/research/REU/comp/matode.pdf

13. Books Recommended

- 1. Brian H. Hann, Daniel T. Valentine, Essential MATLAB for Engineers and Scientists (7th ed.), Academic Press Inc., 2019.
- 2. Amos Gilat: MATLAB: An Introduction with Applications (8th edition), John Wiley & Sons Inc, 2016.

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1. Name of the	e Departme	nt: Environn	nenta	l Science	_			
2. Course Nan	ne	Ecology & I	Biodi	versity	L	T	Р	Credit
3. Course Cod	le	17030713			4	0	0	4
4. Type of Cou	ırse (use tic	k mark)	Co	re ()	DSE (SEC ()	
5. Pre-requisit any)	e (if	10+2	6.]	Frequency (use tick marks)	Even ()	Odd (√)	Either Sem ()	Every Sem ()
7. Total Numb Lectures = 52	er of Lectu	res, Tutorial	s, Pra	actical (assun Tutorials = I	ning 15 we	eks of one Practical =	semester) Nil	
8. Course Desc	cription:							
Ecosystem is the	e interaction	between biot	tic and	l abiotic comp	onents of e	ecosystems.	This cours	e will cov
cological facto	ors & the inte	eraction, adap	otation	and function	al adjustm	ent of organ	isms to the	changes i
physical environ	nment. This	course will co	over d	letail understa	nding of pa	attern of bio	diversity an	nd will hel
n understandin	g strategies :	for conserving	g ecos	system and bio	odiversity.			
). Course Obje	ectives:						i.	
The objectives of	of this cours	e are:	23					
1 To intro	duce the stu	dente with fo	otors	rooponsible C	n overlast.	61:0		
$\frac{1}{2} \text{To und}$	motor d his 1	actits with fa	ctors	responsible fo	evolution	n of life.		
2. To unde		versity patter	n and	human intera	ction with	ecological	world.	
3. To know	v about vari	ous conventio	ons an	d treaties for	biodiversit	y conservat	ion.	
4. To know	v about the	working of or	ganiz	ations for wild	tlife conse	rvation.		
0. Course Out	tcomes (CO	s):						
pon successful	l completion	of this cours	e, the	student will b	be able:			
1. To unde	erstand princ	iples of ecolo	ogy, p	opulation and	resource of	lynamics		
2. To unde	erstand the re	elationship of	living	g organisms w	vith their e	nvironment		
3. To know	v the effect of	of human civi	ilizati	on and industr	ialization	on biodiver	sitv	
4. To knov	v about the s	ustainable de	velor	ment for prot	ection of e	cosystem a	ad concerni	20
biodiver	sity.		, erop			cosystem a		ng
11. Unity	wise details	d content						
nit-1	Number	of lectures =	= 13	Ecology &	Ecosyster	n		
cosystem: Def errestrial and a	inition, stru quatic ecos	icture and fu ystems, Bios	unctio phere	n, Evolutiona , Ecosystem	ary ecolog productivi	y, Earth's ty, Adapta	major eco tions to th	e physica
nvironment, Ec	osystem stal	oility, Ecolog	ical S	uccession, Ec	ades, Ecot	ypes, Ecoto	ne.	
nit – 2	Number	of lectures =	= 13	Population	Ecology			
opulation: Inter odels, r & k Se oltera Model.	action, distr lection, Cor	ibution, and a cept of carry	abund ing ca	ance; Species pacity, Conce	and commept of Habi	unities, Su tat and Eco	rvivorship logical Nic	curves and he, Lotka
Que	106/20	st	(1.191			/	



Unit – 3	Number of lectures = 13	Biodiversity
Historical and ge	ographical pattern of biodivers	sity; Types of biodiversity, levels, and gradients of
Biodiversity, The	eories of biological classification	on, IUCN categories, red data book, green data book,
Biodiversity in the	ie welfare of mankind.	
Unit – 4	Number of lectures = 13	Conservation and Sustaining Strategies
nternational con	ventions, treaties and protocols	s for Biodiversity Conservation, Human impacts: threats
evelopment	blodiversity, Kole of wwF, w	VCU, CITES, TRAFFIC, Concept of sustainable
2. Brief Descri	ntion of self learning / F-lear	ning component
1. https://ww	w conserve-energy-future cor	a/what is an ecosystem php
2 https://ww	w voutube com/watch?v=pv-V	What-is-an-ecosystem.php
3. https://ww	w.slideshare.net/TalemosSeta/	decture-note-on-biodiversity conservation
4. https://npt	el.ac.in/courses/102104068/2	recture note-on-broatversity-conservation
5. https://ww	w.easybiologyclass.com/biodi	versity-introduction-definition-classification-importance
measurem	ent-of-biodiversity	
3. Books Recon	amended	
1. Fundamen	itals of Ecology by Eugene P. (Odum, Gary W. Barrett - Publisher · Cengage(5
edition) IS	BN: 9780534420666	, may a martine a demonder . Conguge(s
2. Ecology a	nd Field Biology by R.L Smith	, Publisher: Benjamin Cummings ISBN-10:
03210429	05	
3. Principles	of Environmental Science by V	William Cunningham and Mary Cunningham
Publisher:	McGraw-Hill Education; 8th e	edition ISBN-10 : 0078036070
4. Global Bio	odiversity: Volume 2: Selected	Countries in Europe by Apple Academic Press ISBN:
97817718	87175	
5. Ecology of	r Natural Resources by Francoi	is Ramade Publisher : John Wiley & Sons Inc ISBN
978047190	51044	
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1. Name of the D	epartment:	Environmental So	ciences			
2. Course Name	Ecology ar Lab	nd Biodiversity-	L	Т	Р	Credits
3. Course Code	1703071		0	0	4	2
4. Type of Course mark)	e (use tick	Core ()	DSE (✓)	SEC ()		
5. Pre- requisite (if any)	10+2	6. Frequency (use tick marks)	Even ()	Odd (✓)	Eith er Sem ()	Ever y Sem
7. Total Number	of Lectures,	, Tutorials, Practic	cal.			
Lectures = Nil		Tutorials = Nil	Prac	tical = 52		
This Course will in This course will als an individual organ 9. Course Object The objectives of th	troduce the s o give a plat ism along w ives: is course are	students to the basi form to develop di ith biodiversity sur	c concept of fferent metho vey and cons	Ecology and body to study ervation.	nd Biodi [,] y populat	versity. ion size of
 To learn concept To describe the To know about the 	ts of biodive methods to s the working	ersity pattern and vasted of organizations for	alue of biodi ze, frequency r wildlife co	versity. v and densi nservation	ty.	
 Jpon successful cor To demonstrate To explain the or To evaluate the To know about national wildlift 	npletion of t fieldwork s distribution a relationship the role of w e.	his course, the stud kills like species id and abundance of d /interactions amon vildlife and ground	lent will be a entification a lifferent plan g the differer problems in	ble: and ecologi t species in at species. the protect	cal surve any regi ion of loc	ey. on. cal and
1. List of Experim . Determination of r . To determine the f . Estimation of chlo . Estimation of orga	ents minimum siz frequency an rophyll cont nic carbon c	ze of quadrat for co ad density of specie ent in plant sample content in plants.	mmunity stu s in a given a s.	dy. <mark>area.</mark>	<u>.</u>	
Estimation of Prot	ein content i	n plants.				
Walton Value	lent 1. b. 22	buyubh	22	1/6/2	PD PD	1.6.20

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7. To determine diversity indices in a given area

8. Study of major National parks, Biosphere reserves and Wildlife Sanctuaries and their Flora and Fauna.

9. Biodiversity Photography: Field work

Case study of the reintroduction of wild animals. 10.

12. Books Recommended

- Fundamentals of Ecology by Eugene P. Odum, Gary W. Barrett Publisher : 1. Cengage (5 edition), ISBN: 9780534420666
- Ecology and Field Biology by R.L Smith , Publisher: Benjamin Cummings ISBN-2. 10:0321042905
- 3. Global Biodiversity: Volume 2: Selected Countries in Europe by Apple Academic Press, ISBN: 9781771887175
- 4. Ecology of Natural Resources by Francois RamadePublisher : John Wiley & Sons Inc ISBN 9780471901044

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1 Name of the Depart	ment: Environmen	tal Science		1				
2. Course Name	Air and Noise Poll	ution	L		Т		Р	Credit
3. Course Code	17030715		4		0		0	4
4. Type of Course (use	e tick mark)	Core ()]	DSE (<u> </u>	SEC (0	_
5. Pre-requisite	10+2	6. Frequen	cy	Even	() Odd	Either		Every
(if any)		(use tick ma	irks)		(*)	Sem (Sem ()
7. Total Number of L	ectures, Tutorials, P	ractical (assumin	ig 15 we	Prove	tionl – Nil	er)		
Lectures = 52		1 utoriais = Mi		Fra	ciicai – Ivii			
Atmospheric Pollution	and control is base	d on the informa	ation al	out d	ifferent proc	esses in	n At	mospheri
1 mispherie relation t	a coses and particula	to matter. This c	OUTRE N	vill co	ver basic co	ncents	in at	mosnheri
chemistry in relation u	b gases and particula	the detail knowl	edge re	lated t	o effect of h	uman a	ctivit	ies on th
chemistry and hoise po	nution. It also covers	alth affaata and a	ontrol a	maasu	res for air a	nd nois		lution ar
natural atmospheric pro	operties. Also the net	and effects and c	onuor	measu	les foi all a	nu nois	c poi	iunon ai
studied.								
9. Course Objectives:	ture photochomictry	and chamical pro	000000	victing	r in the atmo	sphere		· · · · · ·
1. To describe the struc	ture, photochemistry	and chemical pro	haria al	Aisting		spilere.		
2. To understand the co	oncepts and unitying f	reatures of atmosp	meric ci	lemist	y.	nta		
3. To know about caus	es, effects and control	I measures of gase	ous and	i partic	ulate polluta	ints.		
4. To understand the sc	ources and harmful im	pacts of noise pol	lution c	on hum	ans and othe	er organ	isms.	
10. Course Outcomes	(COs):							
Upon successful compl 1. To apply the concep	etion of this course th ts and unifying featur	e student will be a res of atmospheric	able, chemis	try.				
2. To understand the in	terconnections betwe	en different layers	s of atm	osphei	e and their in	mportar	nce.	
3. To understand the effective of the ef	ffect of human activiti	ies on the natural	atmosph	nere.				
4. To understand estim	ation methods of diffe	erent air pollutant	s.					
5. To know about the c	lifferent sound indices	s and control meas	sures fo	r noise	pollution.			
11. Unit wise detailed	content							
Unit-1 Numbe	r of lectures = 13		Air Po	llution	and its effe	ects		
Air pollution: composit	ion and structure of a	tmosphere, global	implica	ations	of air polluti	on. Sou	rces a	and
Classification of air pol	lutants, Indoor air pol	llution, Effects of	air poll	utants	on humans,	animais	, prop	berty and
plants, Case Studies.								
Unit – 2 Numbe	r of lectures = 13		Disper	sion o	f pollutants	1 1		-
Meteorological aspects	of air pollution dispe	rsion; lapse rate, i	nversio	n and s	stability, win	d veloc	ity an	nd d
turbulence, plume beha	viour, dispersion of a	ir pollutants, the (Jaussiai	Plum	ie wodel, sta	ck neig	nt an	u
dispersion.	r of lectures = 13		Airpo	Ilutio	control de	vices		11111
Ambient air quality sta	ndards. Ambient air s	ampling: gaseous	and par	ticulat	e pollutants,	stack sa	ampli	ng, IOT
based monitoring syste	ms, Control devices f	or particulate and	gaseous	s conta	minants: gra	vitation	al set	ttling
chambers, cyclone sepa	arators, wet scrubbers.	, fabric filters (Ba	g-house	filter)	, Electrostati	ic precip	pitato	rs (ESP)
Catalytic converters.								
Unit – 4 Numbe	r of lectures = 13		Noise	polluti	on		-	
Basics of acoustics and	specification of soun	id; sound power, s	ound in	tensity	and sound p	bressure	leve	is; plane,
point and line sources,	multiple sources; effe	ects of noise on hu	mans, n	ioise st	andards and	limit va	ilues;	noise
instrumentation and mo	onitoring procedure. N	voise maices.						
· +	In							
NXX	-h V2	0 10.						
Nell	0~ (L. miles	1	10-				
U u	11.1	July Tuly		all.	7		_	
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	106.20		V	10	· \	r 6'2	cer	
	-100			1				

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12. Brief Description of self learning / E-learning component

1. http://acmg.seas.harvard.edu/people/faculty/djj/book/powerpoints/index.html

2. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-84j-atmospheric-chemistry-fall-2013/lecture-notes/

13. Books Recommended

- Industrial Noise Control: Fundamentals And Applications, 2Nd Edition by H. Bell; Douglas H. Bell 1. Publisher : T&F India, ISBN : 9781138583191
- 2. Introduction to Environmental Engineering and Science (3rd Edition) by Gilbert M. Masters; Wendell P. Ela Publication : Pearson, ISBN : 9780131481930
- 3. Introduction to Atmospheric Chemistry, Daniel J. Jacob, Publisher: Cambridge University Press, ISBN-13: 978-0521778008
- 4. Air Pollution: Its Origin and Control.3rd Edition, Kenneth Wark and C F Warner, Publisher : Pearson; ISBN-13 : 978-0673994165
- 5. Air Pollution Control Engineering. Ist Edition by Rao and Rao, Publisher : McGraw Hill Education 6. ISBN-13 : 978-0074518717

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1. Name of the Depar	rtment: Environme	ntal Science	1			
2.Course Name	Air and Noise Poll	lution- Lab	L	Т	Р	Credits
3.Course Code	17030716		0	0	4	2
4.Type of Course (us	e tick mark)	Core ()	DSE (✔)		SEC ()	
5.Pre-requisite (if any)	10+2	6.Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem (
. Total Number of L	ectures, Tutorials, l	Practical.				
ectures = NII		Tutorials = Nil	Practica	al = 52		
Course Description	:			0.11.00		
ir quality assessment	To know properties	f different and the principle a	and workin	g of diffe	rent instru	ments used fo
ne residence and trans	nort of pollutents in	of different pollutants and	d their sam	oling met	hodology.	To understand
to residence and trans	port of pondiants in a	aunosphere.				
.Course Objectives:						
	course are:					
2. To some interview	oncentration of Partic	culate Matter in air.				
2. To acquaint wi	ith NO_2 measurement	procedure.				
3. To acquaint wi	th SO_2 measurement	procedure.				
4. To get familiar	with stack monitorin	ng procedure.				
5. To understand	procedure of noise m	easurement using Noise	e level mete	er.		
0.Course Outcomes ((COs):				3	A CONTRACTOR OF A CONTRACTOR OF A CONTRACTOR OF A CONTRACTOR A CONTRAC
pon successful compl	etion of this course, t	the student will be able t	to:			
1. Use different in	nstruments for air qua	lity assessment.				
2. Analyze variou	is parameters for air q	luality assessment like c	oncentratio	on of NO	2, SO ₂ , CO	, PM etc.
3. Explain the sou	urces of different type	es air pollutants.				
4. Understand the	working and applica	tions of Sound level me	ter.			
List of Experiment	s					
1. Determination	of respirable suspend	ed particulate matter (R	SPM) in ar	nbient ai	r quality.	
2. Determination of	of NO_2 concentration	in ambient air quality.				
3. Determination of	of SO_2 concentration	in ambient air quality.				
4. Study of amble	nt noise level.					
5. Stack monitorin	ig and analysis of diff	terent pollutants.				
The compare the	of Carbon Monoxide.					
7. To compare the	pollution level of dif	ferent location.				
6. The study the set	ty monitoring of cam	pus.				
Or 201 10b	Latt 16/201	- Lucyub - 1/06/22	yyy	PD 1	hun 6. zon	-



10. To study the occupational health effects of noise pollution: case study/survey.

12.Books Recommended

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- 1. Air pollution by Rao & Rao, Publisher : McGraw Hill Education ISBN-13 : 978-0074518717
- 2. National Ambient Air Quality Series: Central Pollution Control Board

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1. Name of the Departm	ent: Mathematics						
2. Course Name	PYTHON Lab	L	T		P		
3. Course Code		0	0		4		
4. Type of Course (use tick mark)		Core ()	DSE ()	AEC ()	SEC 0	OE ()	
5. Pre-requisite (if any)		6. Frequen cy (use tick marks)	Even ()	Odd ([])	Either Sem ()	Every Sem ()	
7. Total Number of Lect	ures, Tutorials, Pra	ctical					
Lectures $= 0$			Tutorials =0		Practical = 52		
8. Course Description:	and the second		1				
participant to be able to cr provide knowledge and ex areas. 9. Course Objectives: This course aims to introdu script elements such as var own Python programmes fo	eate and execute Pyr periences to students ice the fundamentals iable and flow contro or various numerical	thon programs. T that serve as a f of Python progra of structures. This methods related	The lectures oundation mming. Stu- course wil to the problem	s and preser for continue udents will I I enable the em of integ	tations are d learning of be learning of students to ration, diffe	designed to of presented core Python write their rentiation,	
solution of Ordinary different	ential equations and s	system of linear e	equations.				
10. Course Outcomes (CC	Ds):						
After completing this cours 1. To install and run th 2. To create and execut 3. To understand the c 4. Be able to read data 5. To Plot data using a	se students are expect the Python interpreter ate Python programs, concepts of file I/O, a from a text file usin appropriate Python vi	ted to be able: g Python. sualization librar	·ies.				
11. Unit wise detailed con	tent						
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List of	Practicals to perform in a computer lab using Python.
1.	Write a program to find the sum of <i>n</i> natural numbers.
2.	Write a program to check if a number is prime or not.
3.	Write a program that stores marks obtained by a student in three different subjects and gives the following outputs: Fail-if less than 40% in at least two subjects, Pass:If more than 40% in all the subjects and Re-If less than 40% in exactly one subject.
4.	Make a list of the numbers from one to one million, and then use a for loop to print the numbers.
5.	Create, edit and delete items in a dictionary.
6.	Write a program to find roots of an equation by bisection method.
7.	Write a program to find roots of an equation by Newton-Raphson method.
8.	Write a program to solve a system of equations by Gauss-Jacobi method.
9.	Write a program to integrate a function by trapezoidal rule.
10.	Write a program to integrate a function by Simpson's 1/3 rd rule.
11.	Write a program to solve a first order ODE with given initial value by Euler's method.
12.	Write a program to solve a first order ODE with given initial value by Runge-Kutta4 th order method.
12. Bri	ef Description of self learning / E-learning component
I .	https://www.youtube.com/watch?v=Y3Ri2GdYfYg&list=PLqftY2uRk7oXvERQEgATSr- KzAh8WLWD
2.	https://www.youtube.com/watch?v=eoPsX7MKfe8&list=PLIdgECt554OVFKXRpo_kuI0XpUQKk0y cO
13. Bo	oks Recommended
1. Jaso SPD, 2	n Montojo, Jennifer Campbell and Paul Gries: An Introduction to Computer Science using Python 3, 014.

2. P. K. SinhaandPritiSinha: Computer Fundamentals, BPB Publications, 2007.

3. T. Budd: Exploring Python, Tata Mc-Graw Hill, 2011.

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SEMESTER-VIII (DSE)



. Name of the D	epartment: Physics					
. Course Name	Advance Quantum	L		Т		Р
	Mechanics	and the second second				
. Course Code	17030801	4		0		0
. Type of Cours	e (use tick mark)	Core ()	DSE ()	AEC ()	SEC $()$	GE ()
. Pre-requisite		6. Frequency	Even	Odd ()	Either	Every
(if any)		(use tick	(\checkmark)		Sem ()	Sem ()
		marks)				
Total Number	of Lectures, Tutoria	als, Practical				
Lectures $= 52$		Tutorials =	0	Practical	= 0	
Course Descri	ption:					
d non-relativistic uation is also cov	s the physical and ma systems. Relativistic rered.	quantum theory	c of quant like Klei	um mecha n-Gordon	nics for rel equation a	ativistic nd Dirac
e primary objecti	ive is to teach the stud	lents the physics	and ma	thematical	basis of a	iontum
echanics for non-	relativistic systems ar	d Relativistic o	iantum th	eory like	Clein Cord	lon
uation and Dirac	equation is also cover	red		leory like I	Ciem-Gord	ion
. Course Outcon	nes (COs):					-
urse Learning Ou	utcomes Students will	llearn			7	
1. The mathemat	ical formalism of Hi	ilbert space. He	rmitian C	perators	Eigen valu	es. Eigen
states and unita	ary operators, which f	form the fundam	ental basi	is of quant	um theory	
2. Application to	simple harmonic os	cillators, hydros	gen-like a	itoms and	angular m	omentum
operators will t	each the students how	to obtain Eigen	values an	d Eigen sta	ates for suc	h systems
elegantly.						
3. The topic of de	ensity matrices that pl	ays significant r	oles in qu	antum inf	ormation th	heory and
statistical mech	nanics will also help t	he students cons	iderably.			
. Unit wise detail	led content					
nit-1 Number	of lectures = 13 Tit	tle of the unit: A	Abstract	formulatio	on of Quar	ntum
	M	echanics				
athematical prope genvalues and eigechanics. Matrix nnection with w hange of basis and	rties of linear vector s genvectors. Orthonor representation of o ave mechanics. Con unitary transformation	paces. Dirac's b mality, complete perators. Positi muting operato	ra and ket teness, cl on and p ors. Gene	notation.] osure. Pos momentum eralised ur	Hermitian of stulates of represent accrtainty	operators, quantum tations – principle.
nit - 2 Number	of lectures - 12	lo of the mile (Puort	Demost th	corem.	
nt - 2 Rumber (ne of the unit: (Luantum	Dynamics	\$	
hrodinger picture simple harmonic nservation laws, rmonics. Spatial t ensity matrices - servable, time-even	Heisenberg picture, oscillator problem by Symmetries in Quar translation – continuc properties, pure an olution, reduced dens	Heisenberg equa y the operator m ntum Mechanics ous and discrete, id mixed densi ity matrix	ation of m ethod, ge : hydro time tran ty matric	notion, class neral view gen-like a nslation. p res, expect	sical limit, of symme toms and arity, time tation valu	Solution etries and spherical reversal, ie of an
it - 3 Number	of lectures = 12	le of the write	naulau	Anna		· · · ·
ut-5 Number	or lectures - 13 11	le of the unit: A	Angular M	romentur	n	
erators and their r	ons of angular mon natrix representations	nentum operato Spin angular n	rs. Eigen 10mentun	values, ei n and Paul	genvectors i matrices.	. Ladder Identical
	Ja	8	per	l	Mule	J3



particles: Many-particle systems, Exchange degeneracy, symmetric and anti-symmetric wavefunctions. Pauli exclusion principle. Addition of angular momenta. Clebsch-Gordan coefficients. Wigner - Eckart theorem.

Unit - 4 Number of lectures = 13 Title of the unit: Relativistic Quantum Mechanics

Klein-Gordon and Dirac equations. Properties of Dirac matrices. Plane wave solutions of Dirac equation. Spin and magnetic moment of the electron, non-relativistic reduction of the Dirac equation.

12. Books Recommended

1. Quantum Mechanics, B. H. Bransden & C. J. Joachain (Pearson Education, 2000)

2. Principles of Quantum Mechanics, R. Shankar (3rd Ed., Springer, 2008)

3. Quantum Mechanics (Vol. I), Claude Cohen-Tannoudji, Bernard and Frank Laloe 16 (Wiley, 1977)

4. Modern Quantum Mechanics, J. J. Sakurai (Addison-Wesley, 1993)

5. Advanced Quantum Mechanics, F. Schwabl (Springer, 2000)

6. Quantum Mechanics, A. S. Davydov (2nd Ed., Pergamon, 1991)

7. Quantum Mechanics, Eugen Merzbacher (3rd Ed., Wiley, 1997)

8. Quantum Mechanics: Concepts and Applications, Nouredine Zettili (Wiley 2nd edition 2009)

13. Online Links

1. https://en.wikipedia.org/wiki/Mathematical_formulation_of_quantum mechanics

2.https://www.youtube.com/watch?v=6Wfe82jBxm4&list=PLaNkJORnlhZlLjsbsfiQaw3Hpf1A oqjWb

seve file

3. https://www.youtube.com/watch?v=x-PS5QirFu8



1. Name of the Dep	partment: Physics		See See		12 (S. 16)	
2. Course Name	Physics Practical-3	L		Т		Р
3. Course Code	17030802	0	0		1	4
4. Type of Course	(use tick mark)	$\begin{array}{c c} \textbf{Core ()} & \textbf{DSE} & \textbf{A} \\ (\sqrt{)} & (\sqrt{)} & (\sqrt{)} \\ \end{array}$		AEC	SEC O	GE ()
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even $()$	Odd ()	Either Sem ()	Every Sem ()
7. Total Number o	f Lectures, Tutorials,	Practical				
Lectures = 0	Tutorials = 0 Practical = 52					

8. Course Description:

In this course student will gain the practical and simulation knowledge about the reflection and

transmission of a plane quantum wave at a lD Woods-Saxon potential, Schr0dinger Equation for

arbitrary potential, Energy levels with corresponding eigenfunctions, Quantum mechanical scattering problem, of Electron spin resonance- determine magnetic field as a function of the resonance frequency etc.

9. Course Objectives:

1. To study Probability Density as a function

2. To study quantum mechanical scattering problem

3. Numerical and exact solution for Schrodinger equation for Particle in a box Quantum harmonic oscillator

4. Wave packet propagation using exponential of H

10. Course Outcomes (COs):

1. Demonstrate the comprehensive and theoretical knowledge of Quantum Mechanics and Schrödinger equations with Angular Momentum operator and representation

2. Various tools to calculate Eigen values and total angular momentum of particles

3. Study of Approximation Method and scientific Time independent and dependent perturbation theory

4. To analyze quantum & Schrodinger equations based research and with its applications

11. List of Experiments

- 1. Wave packet propagation using exponential of H and Parameters for solving the problem in the interval 0 < x < L
- 2. Calculate Probability Density as a function of time for a particle trapped in a doublewell potential.
- 3. Calculate first and second derivative numerically showing how to write differential operator as a matrix.
- 4. Gaussian wave packet as solution of the free Schrödinger equation (Computational and simulation)
- 5. Matrix representation of differential operators and Solving for Eigenvectors & Eigen values of Infinite Square Well.

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- 6. The quantum mechanical scattering problem (Computational and simulation) (In this practical we will calculate the reflection and transmission of a plane quantum wave at a ID Woods-Saxon potential using an approach that considers the incoming, the reflected and the transmitted wave parts)
- 7. Numerical and exact solution for Schrodinger equation for Particle in a box Quantum harmonic oscillator
- 8. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
- 9. Study of H₂ atom wave function using quantum mechanics

10. Find several lowest eigenmodes V(x) and eigenenergies E of 1D Schrodinger equation -1/2*hbar^2/m(d²/dx²)V(x) + U(x)V(x) = EV(x) for arbitrary potentials U(x).

12. Books Recommended:

- 1. P. A. M. Dirac, The Principles of Quantum Mechanics, 1st ed., (Oxford University Press, 1930).
- 2. C. C. Silva and R. de Andrade Martins, "Polar and axial vectors versus quaternions," Am. J. Phys. 70, 958-963 (2002).
- 3. R. W. Robinett, Quantum Mechanics: Classical Results, Modern Systems, and Visualized Examples, (Oxford University Press, 1997).
- 4. H. Gould, "Computational physics and the undergraduate curriculum," Comput. Phys. Commun. 127, 610 (2000); J. Tobochnik and H. Gould, "Teaching computational physics to undergraduates," in Ann. Rev. Compu. Phys. IX, edited by D. Stauffer (World Scientific, Singapore, 2001), p. 275; H. Gould, J. Tobochnik, W. Christian, An Introduction to Computer Simulation Methods: Applications to Physical Systems, (Benjamin Cummings, Upper Saddle River, NJ, 2006) 3rd ed..
- 5. R. Spenser, "Teaching computational physics as a laboratory sequence," Am. J. Phys. 73, 151-153 (2005).
- 6. D. Styer, "Common misconceptions regarding quantum mechanics," Am. J. Phys. 64, 31-34 (1996).
- A. Goldberg, H. M. Schey, J. L. Schwartz, "Computer Generated Motion Pictures of One-Dimensional Quantum Mechanical Transmission and Reflection Phenomena," Am. J. Phys. 35, 177-186 (1967).
- 8. C. Singh, M. Belloni, and W. Christian, "Improving students' understanding of quantum mechanics," Physics Today, August 2006, p. 43.
- 9. These MATLAB commands are explained in an extensive on-line, tutorial within MATLAB and which is also independently available on the MathWorks website, <u>http://www.mathworks.com/</u>.
- 10. D. J. Griffiths, Introduction to Quantum Mechanics, 2nd Ed., Prentice Hall 2003.
- 11. A. Garcia, Numerical Methods for Physics, 2nd Ed., (Prentice Hall, 1994).

12. G. Lindblad, "Quantum Mechanics with MATLAB," available on internet, http://mathphys.physics.kth.se/ schrodinger.html.

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. Name of the Dep	artment: Physic	s					
2. Course Name	Physics of Nano	materials	L		Τ	Р	
Course Code	17020802	Ç	1		0	0	
4 Type of Course	(use tick mark)	Core O	4	D	<u> </u>		Cab
5. Pre-requisite	(use tiek mark)	6 Frequ	ency	Even ()	$\frac{1}{10000000000000000000000000000000000$	Fither	Every
(if any)		(use ti	ck			Sem()	Sem ()
(marks	3)				
7. Total Number of	f Lectures, Tutor	ials, Pract	ical		Alexandre Alexandre		
Lectures = 52		Tutoria	$\mathbf{ls} = 0$		Practical =	= 0	
6. Course Descript	ion:						
It includes Fundame Nanomaterials and N	ntal of Nanomate anomaterials and	erials, Nano Devices	ofabric	ation Tec	hniques, C	Characteri	zation of
9. Course Objectiv	ves:						
The course aims to	provide students	with an ur	iderstai	nding of	the basics	of nanor	naterials
echniques used in	fabrication of r	nanomateria	als, ch	aracteriza	ation of d	lifferent	types of
nanomaterials. It also	gives the idea he	ow to desig	gn elect	ric devic	es, magnet	ic and ga	s sensors
etc. using nanomateri	als.						A.
10. Course Outcome	es (COs):						
After the successful c	completion of the	course, stud	dents w	ould be a	ble to		
. understand the fund	damentals of nanc	materials.					
2. understand differer	nt fabrication tech	niques for 1	the nan	omateria	s		
3. understand the basi	cs of the different	characteriz	zation t	echnique	s used in ba	asic reseau	ch in the
field of nanoscience.							
3. describe the basic i	nvolved in the dea	sign of dev	ices ba	sed on na	notechnolo	ogy.	
1. Unit wise detaile	d content	e					
Definition of nonotoo	$\frac{\text{of lectures} = 12}{\text{hpology}}$	Title of	the un	it: Funda	mental of I	Nanomate	rials
anoscale Function	al enhancement	lize depend	dence o	n moltin	of propert	les of ma	terials of
vanour pressure N	ucleation Size	dependence		Chemica	g point, Si	ze depend	lence on
nteractions. Size der	endence on Surfa	ace tension	of sol	id surfac	es Quantu	m confin	ement &
energy levels, Band s	tructure, Density	of states in	0D. 1I	D. 2D &	3D materia	ls. Quant	um dots
wires, & wells.	,		,	,		no, Quunt	un uoto,
Unit - 2 Number	of lectures = 14	Title of	the un	it: Nanof	abrication '	Technique	es
Fop down and bottom	m up approaches	to nanofal	oricatio	n, Nucle	ation & gr	owth med	chanism,
Optical & electron be	am lithography, T	'hin films d	epositio	on, Evapo	oration, Spi	uttering, E	Electrode
position and sol Gel	Fechnique, Plasm	a assisted c	chemica	ıl vapour	deposition	, Molecu	lar beam
epitaxy, Atomic layer	deposition.						
Jnit - 3 Number	of lectures = 12	Title of	the uni	t: Chara	cterization	of Nanon	naterials
X-ray diffraction tech	niques, Scanning	transmissio	on elect	ron micr	oscopy, SE	M, TEM,	Contact
vivon-contact metho	ds of surface chai	racterizatio	n, Atoi	nic force	microscop	by, FTIR,	Surface
nasina resonance teci	iniques, Electron	spectrosco	py tech	niques III	ke AES, XI	'S, SIMS	
Init - 4 Number	of lectures $= 14$	Title of	the uni	t. Nanon	antoriala ar	d Davias	
Carbon based nanon	naterials Small	and Large	Fuller	the Ivalion	Other Bu	ckyballa	Carbon
anotubes and their F	Electronic structur	e. Graphen	e. Met	al matrix	composite	s Single	electron
levices, Molecular e	lectronic devices	. Coupled	quanti	m dots	Spintronic	s Ultra-	sensitive
nagnetic sensors, Spi	n dependent trans	istors. Phot	tonic de	evices.	Spintionit	s, ona-	
,,,,,,,			and an		D-		/ .
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12. Brief Description of self-learning / E-learning component:

To understand basic concepts in detail, students may get study materials on following links. https://onlinecourses.nptel.ac.in/noc18_ph02 https://ocw.mit.edu/courses/physics/

https://www.mooc-list.com/

13. Books Recommended

- 1. John H. Davies. The Physics of Low Dimensional Semiconductors. Cambridge University Press.
- 2. J.J. Ramsden. Nanotechnology- An Introduction. William Andrew Elsevier.
- 3. Ning Xi and King W. Chiu Lai. Nano-optoelectronics Sensors and Devices. William Andrew Elsevier.
- 4. V.V. Mitin, V.A. Kochetp and M.A. Stroscio. Quantum Heterostructures: Microelectronics and Optoelectronics. Cambridge University Press.
- 5. G. Cao. Nanostructures and Nanomaterials: Synthesis, Properties and Applications. Imperial College Press.
- C.P. Poole and F.J. Owens. Introduction to Nanotechnology. New York: John Wiley. M. Wilson, K. Kannangara, M. Simmons and B. Raguse. Nanotechnology. Overseas Press.

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Course Name Physics Practical-4 L T P Course Code 17030804 0 0 4 Type of Course (use tick mark) Core () DSE ($$) SEC () Pre-requisite (if any) 6. Frequency (use tick marks) Even ($$) Odd () Either Sem () Sem () Total Number of Lectures, Tutorials, Practical actures = 0 Tutorials = 0 Practical = 26 Sem () Sem () Course Description: T This course includes basics of spectroscopy, UV/Visible spectroscopy, Mossbauer and 2 hotoelectron Spectroscopy, nonlinear phenomenon and applications of Laser spectroscopy Course Objectives: Demonstrate the experimental knowledge of basic spectroscopic techniques that use diff sectroscopy and lasers Experimental knowledge of spectroscopy is solving complex problems, and conceptualizing plutions X-ray diffraction technique Laboratory exercises that illustrate the Provide a degree of experimental skill in the characterizi f nanomaterials Research based knowledge on the techniques and instrumentation for laser and spectroscopy wo ncepts and phenomena that are characteristic of lasers J. Course Outcomes (Cos): Ifter successful completion of the course, students will be able to correlate the theoretical concept (fferent type of spectroscopy and identify its practical applications through experiment procedure at results List of Experiments To determine t	I. Name of the Depa	artment: Physics								
Course Code 17030804 0 0 4 Type of Course (use tick mark) Core () DSE (√) SEC () Pre-requisite (if any) 6. Frequency (use tick marks) Even (√) Odd () Either Even (√) . Total Number of Lectures, Tutorials, Practical .ectures = 0 Tutorials = 0 Practical = 26 . Course Description: his course includes basics of spectroscopy, UV/Visible spectroscopy, Mossbauer and 2 hotoelectron Spectroscopy, nonlinear phenomenon and applications of Laser spectroscopy Demonstrate the experimental knowledge of basic spectroscopic techniques that use diff bectroscopy and lasers <	2. Course Name	Physics Practical	-4	L	Т		P	~		
• Type of Course (use tick mark) Core () DSE (√) SEC () • Pre-requisite (if any) 6. Frequency (use tick marks) Even (√) Odd () Either Sem () Sem () • Total Number of Lectures, Tutorials, Practical actures = 0 Tutorials = 0 Practical = 26 • Course Description: • This course includes basics of spectroscopy, UV/Visible spectroscopy, Mossbauer and 2 hotoelectron Spectroscopy, nonlinear phenomenon and applications of Laser spectroscopy • Course Objectives: • • • Demonstrate the experimental knowledge of basic spectroscopic techniques that use diff bectroscopy and lasers • • Experimental knowledge of spectroscopy in solving complex problems, and conceptualizing slutions X-ray diffraction technique • • Laboratory exercises that illustrate the Provide a degree of experimental skill in the characterize f nanomaterials • • Research based knowledge on the techniques and instrumentation for laser and spectroscopy wo nocepts and phenomena that are characteristic of lasers • • Course Outcomes (Cos); • • • ffer successful completion of the course, students will be able to correlate the theoretical concept fferent type of spectroscopy and identify its practical applications through experiment procedure ad results • List of Experiments • To determine the variation of refra	3. Course Code	17030804		0	0		4			
A Type of Course (use tick mark) Core () DSE (*) SEC () Pre-requisite (if any) 6. Frequency (use tick marks) Even (*) Odd () Either Sem () Even Sem () Sem () S	4 T					- 1-				
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(if any) (use tick marks) (v) Sem () Sem	5. Pre-requisite		6. Freq	luency	Even	Odd ()	Either	Every		
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Measurement and analysis of emission spectrum Organic and Inorganic compound by P minance spectroscopy	. Measurement and and	alysis of ceramics an	d inorgani	ic oxides by I	JV/Visi	ible Absorp	otion Spec	troscopy		
minance spectroscopy	Measurement and a	inalysis of emission	n spectru	m Organic a	and Ino	organic cor	npound b	y Photo		
	Iminance spectroscopy									
Study of balanced state of different stores present in a Que in V	Determination of opt	state of different	UV visibl	e spectroscoj	py of In	organic co	mpounds	1		
bectroscopy	nectroscopy	state of different a	noms pres	sent in a Or	ganic/li	norganic co	ompound	by XPS		
. Study of lifetime of photo luminance emission spectrum using time resolve spectroscopy	1. Study of lifetime c	of photo luminance e	emission s	nectrum usin	o time	resolve spe	etroscory			
provide the second of the second	,	1		poorum uom	ig unit l	coorve spe	enoscopy			

Wede Boos

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Note: The list of the experiment given above should be considered as suggestive of the standard and available equipment. The faculty members are authorized to add or delete from this list whenever considered necessary.

12. Book Recommended:

1. W. Demtroder: Laser Spectroscopy: Basic Concepts and Instrumentation and Instrumentation,

ISBN No. 978-3-662-05155-9, 2003, Springer-Verlag Berlin Heidelberg.

2. J. M. Hollas. High Resolution Spectroscopy, 2nd Edit. ISBN: 978-0-471-97421-5, 1998, Wiley Publication

3. Anne Thorne, Spectrophysics, ISBN No. 978-94-009-1193-2, Edition. 1, 1988, Springer Netherlands.

4. J. M. Hollas. Modern Spectroscopy, ISBN No. 978-0471911210, 1986, Wiley-Blackwell.

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1. Name of the Dep	artment: Chemistry	and the second	A CONTRACTOR								
2. Course Name	Transition Metal Chemistry	L		T	Р						
3. Course Code	17030805		4		0	0					
4. Type of Course ((use tick mark)	Core ()	DSE (\checkmark) AEC () SEC () G								
5. Pre-requisite	NA	6. Frequency	Even (Odd ()	Either	Every					
(if any)		(use tick marks)		0.000	Sem ()	Sem ()					
7. Total Number of Lectures, Tutorials, Practicals											
Lectures = 52 Tutorials = Nil Practical = Nil											
8. Course Description	ion				State State						
This course is aime	d at familiarizing the students w	with the concept of r	netal ligand	bonding, i	mportant n	netal ring					
compounds and the	reaction chemistry of coordina	tion complexes. Th	is course will	ll enable s	tudents to	learn the					
stability aspects of	complexes of transition metal ic	ons with different li	gands, taking	g into acco	ount all the	e possible					
factors, especially the	he chelate effect. Further, the co	ourse will give detai	led descripti	on of the s	substitution	reaction					
mechanisms of octa	hedral and square planar geomet	ries of coordination	complexes a	s well as in	nsight into	the redox					
reaction mechanism	s. A part of this course emphasi	zes on structure and	bonding in	important	inorganic r	ing, cage					
and cluster compou	nds having wide applicability, a	and thus learning ar	nd understand	ding of thi	is chemistr	y will be					
Deficicial to the stud	ients.										
The objectives of the	is course are:										
1 To explain the c	oncent of energetics of hybridize	tion and study carta	in anionia sn	acias of tra	ngition ma	taliona					
2 To explain the s	stability of metal complexes in t	erms of formation c	onstants and	with resp	ect to meta	l ion and					
ligand.	submity of metal complexes in t	crinis of formation c	onstants and	with resp	cet to meta	ii ioii allu					
3. To understand th	he concept of lability and inertne	ss in coordination co	omplexes.								
4. To explain the n	nechanisms of ligand displaceme	nt reactions in octah	edral and squ	are planar	complexes	s					
5. To explain the n	nechanisms of redox reactions in	complexes									
6. To understand th	he chemistry of inorganic rings, c	ages and cluster cor	npounds.								
10. Course Outcom	es (COs):					and the second second					
Upon successful con	npletion of this course, the studer	nt will be able to:									
1. Understand the fin	ner aspects of energetics of hybri	dization and structur	re of iso- and	hetero- po	oly anions						
2. Explain the stabili	ity constants and the various fact	ors determining stab	ility of comp	lexes							
3. Predict the course	of ligand displacement reactions	s in octahedral and s	quare planar	complexes							
4. Predict the course	of redox reactions of transition r	netal complexes.									
5. Develop understan	ad again the structure and bondi	ng of morganic chai	ns, rings and	cages.		-					
II. Unit wise detail	Number of lectures = 8	Title of the unit.	Matal Lizar	J. D J'							
01111-1	Number of lectures = 8	Solution	vietai-Ligan	a Bonaing	g and Equ	ilibria in					
Bent Rule and energy	etics of hybridization. Isonoly ar	d Heteropoly anion	s Stenwise o	nd overall	formation	constanta					
and their interaction	s Trends in stenwise constants	Factors affecting sta	bility of met	al compley	res with ref	Constants Gerence to					
the nature of metal i	on and ligand. Chelate effect and	its thermodynamic	origin	ar complex		cience to					
Unit-2	Number of lectures = 15	Title of the unit: I	Reaction Me	chanism o	of Transiti	on Metal					
		Complexes-I		chumism c	/ ITansici	on mictur					
Inert and labile complexes, Kinetic application of Valence Bond Theory and Crystal Field Theory in lability and											
inertness, Substitution reactions of octahedral complexes, Acid hydrolysis, Factors affecting acid hydrolysis, Base											
hydrolysis, Conjugate base mechanism, Evidences in favour of conjugate mechanism.											
Unit-3	Number of lectures = 15	Title of the unit: I	Reaction Me	chanism o	of Transitio	on Metal					
		Complexes-II									
Substitution reaction	Substitution reactions of square planar complexes, Mechanism of substitution reactions, Trans Effect, Theories of										
Trans Effect, Redox	Reactions, Atom transfer reac	tions, Electron trans	sfer reactions	s, Mechani	ism of one	e-electron					
transfer reactions, O	uter sphere mechanism, Inner spl	nere mechanism, Ma	arcus Hush T	heory	1.00						
Unit - 4	Number of lectures = 14	Title of the unit: (Chemistry of	f Inorgani	c Rings, C	ages and					
		Metal Cages and 1	Vietal Cluste	ers							

I job Ator At



Borazines, Phosphazenes, Boranes, Carboranes, Metalloboranes and metallocarboranes, Wade's rules, Metal carbonyl cluster compounds, Metal halide cluster compounds, compounds with metal-metal multiple bonds, Chevrel phases, Zintl ions

12. Brief Description of self-learning / E-learning component

- 1. https://archive.nptel.ac.in/courses/104/101/104101090/.
- 2. https://archive.nptel.ac.in/courses/104/105/104105085/
- 3. https://www.youtube.com/watch?v=1jRo5fTg0KY

4. http://web.mit.edu/5.03/www/readings/polyhedral_boranes/006_cluster_bonding.pdf

13. Books Recommended

- Selected Topics in Inorganic Chemistry, Malik, Tuli and Madan, New Delhi : S. Chand & Company Ltd, ISBN-13: 978-8121906005
- 2. Inorganic Chemistry, T. Moeller, Wiley; 2nd edition, ISBN-13: 978-0471612155
- 3. Modern Aspects of Inorganic Chemistry, H.J. Emeleus and A.G. Sharpe, Routledge & Kegan Paul PLC; Revised ed edition, Routledge and kegan paul PLC ISBN-13: 978-0710075215
- 4. Chemical Binding by O.P. Agarwal, Disha Publication; Second edition ISBN: 9788188476039, 818847603X.
- 5. Inorganic Reaction Mechanism by Edberg, vol. 70, 1st edition, ISBN: 9780128128343
- 6. Mechanism of Inorganic reaction by F. Basolo R.G. Pearson, John Wiley & Sons Inc, ISBN-13: 978-0471055457
- 7. Structural Principles in Inorganic Compound, W.E.A. Addison, Longmans, ISBN-13: 978-0582442016
- Advanced Inorganic Chemistry by Cotton and Wilkinson, A Wiley-Interscience publication, 5th Edition ISBN-13: 978-0471199571
- 9. Fundamental Concepts in Inorganic Chemistry, Vol. 2, Asim Das and Mahua Das, CBS Publishers & Distributors Pvt Ltd, India; 1st editionISBN-13: 978-8123923512
- Inorganic Chemistry- Principles of Structure and Reactivity by James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Okhil K. Medhi, Prentice Hall; 4 edition, ISBN-13: 978-0060429959
- 11. Inorganic Chemistry by Shriver and Atkins, Oxford; 5 edition ISBN-13: 978-0199236176
- 12. Polyoxometalate Molecular Science by Juan J. Borrás-Almenar, Eugenio Coronado, Achim Müller and Michael Pope, NATO Science Series, (NAII, volume 98), ISBN 978-1402012426



1. Name of the Depa	artment: Chemistry			1997	1 Perfection of							
2. Course Name	Inorganic Chemistry P	ractical - I	L	Т	P	1.500						
3. Course Code	17030806	0	0	4								
4. Type of Course (1	SEC ()	GE (
5. Pre-requisite	NA 6. Frequency Even (1) Odd () Eithe											
(if any)		(use tick marks)		0.000	Sem ()	Sem (
7. Total Number of Lectures, Tutorials, Practicals												
Lectures = Nil Tutorials = Nil Practical = 52 hrs.												
8. Course Description)n											
The lab work focuses	on Ouantitative Inorg	anic Analyses and Cerimetry	v In the form	er analyse	s hinary	nixture						
of metal complexes	will be taken and streng	ths of individual metal ions	in these mixt	ures will	be determ	ined h						
gravimetric and volu	imetric analyses.		in these mixe	ures will	oe determ	inica o						
The latter part deals	with determination of	metal ions by Cerimetry (als	so called cer	imetric t	itration o	r cerat						
oximetry), which is	a redox titration in whic	h a Fe^{2+} -1, 10-phenanthroline	complex (fe	rroin) cha	inges colo	ur at th						
end point. Ferroin is	reversibly discoloured in	n its oxidized form upon titrat	tion with a Ce	e^{4+} solutio	n	ai at ti						
9. Course Objective	s			Solutio								
The objectives of this	s course are:											
1. To separate and	determine the selected b	inary mixtures of metal ions e	employing vo	lumetric 1	nethods							
2. To separate and	determine the selected b	inary mixtures of metal ions e	employing ve	avimetric	methods							
3. To determine the	e strengths of anions usir	ng cerimetry	inploying gr	avinicule	methous							
4. To learn quantita	tive analysis of inorgani	ic compounds										
10. Course Outcome	es (COs)					Mar						
Upon successful com	pletion of this course, th	e student will be able to:			1. Sugar Sugar							
1. Perform quantita	tive estimation of metal	ions from their binary mixtur	es using grav	imetric m	nethods							
2. Perform quantita	tive estimation of metal	ions from their binary mixtur	es using yolu	metric m	ethods							
3. Undertake quant	itative determination cor	nmon anions using Cerimetry		meure m	curious							
4. Quantitatively an	halyse the inorganic com	pounds			11 A. A. A							
and provide the second s												
11. List of Experime	ents (At least seven exp	eriments to be performed by	v the student	:)								
I. Separation and	determination of a r	nixture of following two	metal ions i	nvolving	volumet	ric an						
gravimetric metho	ds											
a. Silver-Coppe	e r											
o. Copper-Nick	el											
c. Copper-Zinc												
I. Copper-Mag	nesium											
e. Copper-Baria	um											
Copper-Nick	el-Zinc											
g. Copper-Nick	el-Magnesium											
II. Determination by	y Cerimetry											
a. Ferrous												
o. Oxalate												
. Nitrite												
12. Brief Description	n of self-learning / E-lea	arning component		1.								
1. https://www.you	tube.com/watch?v=tGH.	I6LUUBIY		C. S. S. S.	Carl Park							
2. https://www.you	tube.com/watch?v=0HZ	7 muDE 8										
3. https://www.you	tube.com/watch?v=GI c	34dVcM										
4. https://www.you	tube.com/watch?v=cptn:	5HCEK54										
13. Books Recomme	nded				1.							
	1				·							

y joy Abor Ab.



1. Basic Principles of Practical Chemistry", Venkatesan, V, Veeraswamy, R and Kulandaivelu, A.R, 2nd edition, Sultan Chand and Sons Publication, New Delhi. ISBN: 9788180547768

2. Advanced Experimental Chemistry", Gurtur, J. N. and Kapoor, R., Vol. I, S. Chand & Co., Ltd, New Delhi ISBN: 9788192959887.

- Advanced Practical Chemistry, 8th Edition, Pragati Prakashan, Siddiqui, I.R., Singh, J., Shrivastava, J., Yadav,L.D.S., Singh, R.K.P., Singh, J., ISBN:: 978-93-86633-50-7
- 4. Advanced Inorganic Analysis, Agarwal, S.K., Lal, K. Pragati Prakashan ISBN: 978-93-87151-38-3
- Vogel's Textbook of Quantitative Inorganic Analysis, Pearson Education, Mendham, J., ISBN-13: 978-8131723258
- 6. Vogel's Qualitative Inorganic Analysis, Pearson Education, Svehla, G., Sivasankar, B., ISBN: 9788131773710.

ADD



1. Name of the Departm	nent: Chemistry				and the second		1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -					
2. Course Name	Instrumental Techn	iques		L	Τ		P					
3. Course Code	17030807			4	0		0					
4. Type of Course (use	tick mark)	Core ()		DSE (√)	AEC ()	SEC ()	GE ()					
5. Pre-requisite	NA	6. Frequei	ncy	Even (✓)	Odd ()	Either	Every					
(if any)		(use tick r	narks)			Sem ()	Sem ()					
7. Total Number of Lec	tures, Tutorials, Pra	actical										
Lectures = 52 Tutorials = 0 Practical = 0												
8. Course Description:			1			•						
In the course, students	will practice hands-	on training	in analy	tical chemis	stry, for e	xample, th	ne testing					
experiments of soil, wate	r, food product, and c	osmetic anal	ysis. In t	the course, P	ractices of	Chromato	graphical					
and instrumental techniq	ues.											
9. Course Objectives												
The objectives of this co	urse are to:											
1. Develop the understa	anding of the Infrared	spectroscop	у									
2. Develop the understa	and ing of the $UV-V$ is	ible/ Near If	¢									
5. Develop analytical a	nd chromatographic s	skills in stude	nto									
10 Course Outcomes (COs)	kins in stude	nts.									
Upon successful complete	tion of this course the	e student wil	l he abl	e to:								
1. Provide the identific	ation of compounds u	ising Infrare	1 spectro	oscony								
2. Deliver the understan	nding the application	of UV-Visil	le spect	roscopy								
3. Provide the understa	anding of the applicat	ion of analy	ical met	thods.								
4. perform the hands-on	n practice with chrom	atographic t	echniqu	es.								
11. Unit wise detailed c	ontent						41 · ·					
Unit-1 Numb	per of lectures = 13	Title of th	e unit:	Infrared Sp	ectroscopy	y						
Infrared spectroscopy:	Interactions with mo	lecules: abs	orption	and scatterin	ng. Means	of excitat	ion (light					
sources), separation of th	ne spectrum (wavelen	gth dispersion	on, time	resolution),	Detection	of the sig	nal (heat,					
differential detection), In	nterpretation of spect	rum (qualita	tive, mi	xtures, resol	ution), adv	vantages c	of Fourier					
Transform (FTIR).												
Unit-2 Numb	er of lectures = 13	Title of th	e unit:	UV-Visible/	Near IR							
UV-Visible/ Near IR –	emission, absorption	h, fluorescen	ce and	photoacousti	ic. Excitati	ion source	es (lasers,					
time resolution), wavele	ngth dispersion (grat	tings, prisms	, interfe	erence filters	s, laser, pl	acement c	of sample					
and S/N) Single and T	Solution), Detection of	a signal (pho	rotation	(quantificat	ion mivt	e arrays, s	ensitivity					
fluorescence and the use	of time photoacousti	fluorescer	retation	(quantificat	lon, mixu	ires, abso	rpuon vs					
Unit-3 Numb	$\frac{\text{or time, photoacoust}}{\text{or of lectures}} = 13$	Title of th	e unit.	Senaration "	Tochnique							
Chromatography Gas	chromatography liqu	id chromato	graphy	supercritical	fluide Im	nortance c	f					
column technology (pacl	king, capillaries). Sen	aration base	d on the	increasing n	umber of t	factors (vo	latility					
solubility, interactions with stationary phase, size, electrical field). Detection: simple vs. specific (gas and												
liquid), Detection as a means of further analysis (use of tags and coupling to IR and MS). Electrophoresis												
(plates and capillary) and	d use with DNA analy	sis.		1 0								
Unit-4 Numb	per of lectures = 13	Title of th	e unit:	Elemental A	nalysis							
Mass spectrometry (elec	trical discharges). At	omic spectro	scopy:	Atomic abso	orption, Ato	omic emis	sion, and					
Atomic fluorescence. Ex	xcitation and getting	a sample in	nto the	gas phase (flames, el	ectrical di	scharges,					
plasmas), Wavelength	separation and reso	lution (depe	endence	on techniq	lue), Dete	ction of	radiation					
(simultaneous/scanning,	signal noise), Interp	pretation (err	ors due	to molecul	ar and ion	nic specie	s, matrix					
effects, other interference	es).											
V V	Kall .	Ab	h	AL	2.							



NMR spectroscopy: Principle, Instrumentation, Factors affecting chemical shift, Spin coupling, Applications **12. Brief Description of self-learning / E-learning component**

- 1. https://nptel.ac.in/courses/102106048/8
- 2. https://nptel.ac.in/courses/104106122
- 3. https://www.digimat.in/nptel/courses/video/104102113/L19.html

13. Books Recommended

- Principles of Instrumental Analysis 6th Edition by Douglas A. Skoog, F. James Holler, and Stanley Crouch ISBN 0-495-01201-7.
- 2. Instrumental Methods of Analysis, 7th ed, Willard, Merritt, Dean, Settle. ISBN: 9788123909431, 9788123909431
- 3. P.W. Atkins: Physical Chemistry. ISBN-10:9780198814740
- 4. G. W. Castellan: Physical Chemistry. ISBN-10:8185015597
- 5. C.N. Banwell: Fundamentals of Molecular Spectroscopy. ISBN-10:9352601734
- 6. Brian Smith: Infrared Spectral Interpretations: A Systematic Approach.ISBN-13:978-0849324635
- 7. W.J. Moore: Physical Chemistry. ISBN-10: 0582442346



2. Course Name Instrumental Techniques Lab L T 3. Course Code 17090808 0 0 0 4. Type of Course (use tick mark) Core () DSE (*) AEC () SEC () G 5. Pre-requisite NA 6. Frequency (use tick marks) Even (*) Odd () Either (*) 7. Total Number of Lectures, Tutorials, Practicalis Even (*) Odd () Either (*) 8. Course Description Tutorials = 0 Practical = 52 hrs. 8. Course Description Calcium, Iron, and Copper in Food by Atomic Absorption. Protein. to identification of compounds using NMR, Spectrometry. It also includes, determination or Calcium, Iron, and Copper in Food by Atomic Absorption. 9. Course Objectives The objectives of this course are to: . 1. Introduce students to Safety Practices in the Chemistry Laboratory. 2. Explain various concepts of techniques for Cobalt and Nickel using various techniques. 4. Learn quantitative/qualitive analysis of mixtures by various techniques. . 1. 1. Bottome de quantitative/qualitive of mistures by various techniques. . 1. 1. Bottome de quantitative/qualitive of mistures by various techniques. . 1. <	I. Name of the Depart	ment: Chemistry					
3. Course Code 0 0 4. Type of Course (use tick marks) Core () DSE (J) AEC () SEC () () (if any) (use tick marks) Core () DSE (J) AEC () SEC () () (if any) (use tick marks) Core (J) Odd () Sem ()	2. Course Name	Instrumental Tech	niques Lab	L		Τ	P
4. type of Course (use tick mark) Core () DSE (√) AEC () SEC() 4 6. Frequency Guse tick marks) Even (√) Odd () Eithet E (ff any) 7. Total Number of Lectures, Tutorials, Practical Sem () Sem	3. Course Code	17030808		0		0	4
S. Pre-requisite NA 6. Frequency (use tick marks) Even (√) Odd () Either Sem (√) 1 7. Total Number of Lectures, Tutorials, Practicals Interval Sem (√) Yether (√) Sem (√) S 7. Total Number of Lectures, Tutorials, Practicals Interval Practical = 52 hrs. S 8. Course Description Includes using instruments, to determine isoelectric pH of protein, to identification of compounds using NMR, Spectrometry. It also includes, determination of Calcium, Iron, and Copper in Food by Atomic Absorption. 9. Course Objectives 9. Course Objectives Introduce students to Safety Practices in the Chemistry Laboratory 2. Explain various concepts of techniques for the identification of compounds. 1. Learn quantitative/qualitive analysis of mixtures by various techniques. I. 1. Upon successful completion of this course, the student will be able to? 1. Detextion of illegal drugs or steroids in athletes 3. Detection of pollutatos rol illegal drugn or steroids in athletes 3. Detection of illegal drugs or steroids in athletes 3. Determination of the isoelectric pH of a protein, 3. Titration curve of an amino acid. 4. Determination of the isoelectric pH of a protein, 3. Titration or of Calcium, Iron, and Copper in Food by Atomic Absorption 9.	I. Type of Course (use	tick mark)	Core ()	DSE (✔)	AEC ()	SEC ()	GE (
(If any) [use tick marks] Sem () S 7. Total Number of Lectures, Tutorials, Practicals [Lectures = 0] Tutorials = 0 Practical = 52 hrs.] 8. Course Description The lab work emphasizes learning of basic skills helpful not only to chemistry students but all those want to pursue any experimental science. It includes using instruments, to determine isoelectric pH 4 protein, to identification of compounds using NMR, Spectrometry. It also includes, determination of Calcium, Iron, and Copper in Food by Atomic Absorption. 9. Course Objectives The objectives of the concepts of techniques for the identification of compounds. 1. Introduce students to Safety Practices in the Chemistry Laboratory 2. 2. Explain various concepts of techniques for the identification of compounds. 3. 3. Learn the determination of a Mixture of Cobalt and Nickel using various techniques. 1. 10. Course Outcomes (COS) Upon successful completion of this course, the student will be able to: 1. Perform various experimental to identification of compounds. 2. 2. Detection of illegal drugs or steroids in athletes 3. 3. Determination of a Mixture of Cobalt and Nickel (UV/Vi spec.) 5. 1. Safety Practices in the Chemistry Laboratory 2. 2. Supertermination of a Mixture of Cobalt and Nickel (UV/Vi spec.) 5.	5. Pre-requisite	NA	6. Frequency	Even (✓)	Odd ()	Either	Ever
7. Iotal Number of Lectures, Tutorials, Practical Lectures = 0 Tutorials = 0 Practical = 52 hrs, 8. Course Description The lab work emphasizes learning of basic skills helpful not only to chemistry students but all those want to pursue any experimental science. Includes using instruments, to determine isoclectric pH // aprotein, to identification of compounds using NMR, Spectrometry. It also includes, determination of Calcium, Iron, and Copper in Food by Atomic Absorption. 9. Course Objectives The objectives of this course are to: 1. Introduce students to Safety Practices in the Chemistry Laboratory 2. Explain various concepts of techniques for the identification of compounds. 3. Learn the determination of a Mixture of Cobalt and Nickel using various techniques. 10. Course Outcomes (COS) Upon successful completion of this course, the student will be able to: 1. Perform various experimental to identification of compounds. 2. Detection of illegal drugs or steroids in athletes 3. Detection of pollutants or illegal drugn or mixtures by various techniques. 11. List of Experiments (Student has to perform the experiments) Instrumental Techniques 1. Safety Practices in the Chemistry Laboratory 2. Determination of the sole extric pH of a protein. 3. Titratin curve of an amino acid.	if any)		(use tick marks)			Sem ()	Sem
Lectures = 0 I utorials = 0 Practical = 52 hrs. 8. Course Description The lab work emphasizes learning of basic skills helpful not only to chemistry students but all those want to pursue any experimental science. It includes using instruments, to determine isoelectric pl 1 optoin, to identification of compounds using NMR. Spectrometry. It also includes, determination of Calcium, Iron, and Copper in Food by Atomic Absorption. 9. Course Objectives The objectives The objectives of this course are to! . 1. Introduce students to Safety Practices in the Chemistry Laboratory . 2. Explain various concepts of techniques for the identification of compounds. . 3. Learn quantitative/qualitive analysis of mixtures by various techniques. . 10. Ourse Outcomes (COs) Upon successful completion of this course, the student will be able to: 1. Perform various experimental to identification of compounds. . 2. Detection of illegal drugs or steroids in athletes . 3. Determinet the quantitative/qualitive of Max transet by various techniques. . 11. List of Experiments (Student has te perform ten experiments) . Instrumental Techniques . . 13. Titration curve of an amino acid. . Determination of the void volume of a get filtration column. <t< td=""><td>7. Total Number of Le</td><th>ctures, Tutorials, H</th><td>Practicals</td><td></td><td></td><th></th><td></td></t<>	7. Total Number of Le	ctures, Tutorials, H	Practicals				
 Course Description The lab work emphasizes learning of basic skills helpful not only to chemistry students but all those want to pursue any experimental science. It includes using instruments, to determine isoelectric pH of protein, to identification of compounds using NMR, Spectrometry. It also includes, determination of Calcium, Iron, and Copper in Food by Atomic Absorption. Course Objectives The objectives of this course are to: Introduce students to Safety Practices in the Chemistry Laboratory Explain various concepts of techniques for the identification of compounds. Learn the determination of a Mixture of Cobalt and Nickel using various techniques. Learn quantitative/qualitive analysis of mixtures by various techniques. Upon successful completion of this course, the student will be able to: Perform various experimental to identification of compounds. Detection of pollutants or illegal dunging or steroids in athletes Determination of the isoelectric pH of a protein. Titration curve of an amino acid. Determination of the isoelectric pH of a protein. Titration curve of an amino acid. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.) Study of Electronic Transitions in Organic Molecules (i.e., acetone in water) Roborption Spectra (Study of Aldehydes and Ketones) Determination of Carbohydrates by HPLC/Paper Chromatography (i.e., chloroform and carbon tetrachloride) Separation of Carbohydrates by HPLC/Paper Chromatography (I.e., chloroform and carbon tetrachloride) Separation of Carbohydrates by HPLC/Paper Chromatography (I.e., chloroform and carbon tetrachloride) Separation	Lectures = 0		Tutorials = 0		Practica	l = 52 hrs	•
 The lab work emphasizes learning of basic skills helpful not only to chemistry students but all hose want to pursue any experimental science. It includes using instruments, to determine isoelectric pl4 protein, to identification of compounds using NMR, Spectrometry. It also includes, determination of Calcium, Iron, and Copper in Food by Atomic Absorption. 9. Course Objectives The objectives of this course are toi. Introduce students to Safety Practices in the Chemistry Laboratory. Explain various concepts of techniques for the identification of compounds. Learn the determination of a Mixture of Cobalt and Nickel using various techniques. 10. Course Outcomes (COs) Upon successful completion of this course, the student will be able to: Perform various experimental to identification of compounds. Detection of pleluants or illegal dumping. Determine the quantitative/qualitive of mixtures by various techniques. 11. List of Experiments (Student has to perform ten experiments) Instrumental Techniques I. Safety Practices in the Chemistry Laboratory Determination of the isoelectric pH of a protein. Titration curve of an amino acid. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.) Study of Electronic Transitions in Organic Molecules (i.e., celoroform and carbon tetrachloride) Osepartion of Carbohydrates by HPLC/Paper Chromatography (i.e., chloroform and carbon tetrachloride) Speartion of Safet-Rosonace of organic compounds Determination of self-learning/ E – learning compounds Mass spectrometry of organi compounds Sublear Magnetic Resonance of organic compounds Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride) Separation of Carbohydrates by HPLC/Paper Chromatography (i.e., chloroform and carbon tetrachloride) Stepterion	S. Course Description		1.11.1.01.1.1				
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 Calcium, Iron, and Copper in Pood by Atomic Absorption. S. Course Objectives The objectives of this course are to: Introduce students to Safety Practices in the Chemistry Laboratory. Explain various concepts of techniques for the identification of compounds. Learn the determination of a Mixture of Cobalt and Nickel using various techniques. I. Learn the determination of a Mixture by various techniques. I. Course Outcomes (COs) Upon successful completion of this course, the student will be able to: Perform various experimental to identification of compounds. Detection of pollutants or illegal dunping Detection of pollutants or illegal dunping. Detection of pollutants or illegal dunping. Determine the quantitative/qualitive of mixtures by various techniques. It List of Experiments (Student has to perform ten experiments) Instrumental Techniques Safety Practices in the Chemistry Laboratory. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.). Sutu of Electronic Transitions in Organic Molecules (i.e., acetone in water) It Absorption Spectra (Study of Aldehydes and Ketones) Determination of a Calcium, Iron, and Copper in Food by Atomic Absorption Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride) Oseparation of Carbohydrates by HPLC/Paper Chromatography Potentiometric Titration of a Chloride-Iodide Mixture Cyclic Voltammetry of the Ferrosyanide/Ferricyanide Couple Nuclear Magnetic Resonance of organic compounds Detection of illegal drugs or steroids in athletes Detection of illegal drugs or steroids in athletes Detection of illegal drugs or steroids in athletes Botestrino of Self-learning/ <i>E</i> – learning compounds Mutszi/www.youtube.com/watch?v=3z	vant to pursue any expe	of compounds usi	ng NMR Spectrome	try It also inc	ermine iso	belectric pl	HOIA
 9. Course Objectives 9. Course Objectives 9. Course Objectives of this course are to: 1. Introduce students to Safety Practices in the Chemistry Laboratory 2. Explain various concepts of techniques for the identification of compounds. 3. Learn quantitative/qualitive analysis of mixtures by various techniques. 4. Learn quantitative/qualitive analysis of mixtures by various techniques. 10. Course Outcomes (COS) Upon successful completion of this course, the student will be able to: 1. Perform various experimental to identification of compounds. 2. Detection of pollutants or illegal dumping 4. Determine the quantitative/qualitive of mixtures by various techniques. 11. List of Experiments (Student has to perform ten experiments) Instrumental Techniques 1. Safety Practices in the Chemistry Laboratory 2. Determination of the void volume of a gel filtration column. 5. Determination of the void volume of a gel filtration column. 5. Study of Electronic Transitions in Organic Molecules (i.e., acetone in water) 7. IR Absorption Spectra (Study of Aldehydes and Ketones) 8. Determination of Calcium, Iron, and Copper in Food by Atomic Absorption 9. Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride) 10. Separation of Carbohydrates by HPLC/Paper Chromatography 1. Potentiometric Titration of a Chloride-Iodide Mixture 12. Cyclic Voltammetry of the Ferroexyanide/Ferricyanide Couple 13. Nuclear Magnetic Resonance of organic compounds 14. Mass spectrometry of organi compounds 15. Detection of illegal drugs or steroids in athletes 16. Detection of spollutants or illegal dumping 12. Evplic Voltammetry of the Ferroids in athletes 13. Nuclear Magnetic Resonance of organic compounds 14. Mass spectrometry of organi c	Calcium, Iron, and Cop	per in Food by Aton	nic Absorption	uy. It also me	indes, del	ermination	1 01
The objectives of this course are to: 1. Introduce students to Safety Practices in the Chemistry Laboratory 2. Explain various concepts of techniques for the identification of compounds. 3. Learn quantitative/qualitive analysis of mixtures by various techniques. 10. Course Outcomes (COS) Upon successful completion of this course, the student will be able to: 1. Perform various experimental to identification of compounds. 2. Detection of illegal drugs or steroids in athletes 3. Detection of illegal drugs or steroids in athletes 3. Detectron of illegal drugs or steroids in athletes 3. Detectron of illegal drugs or steroids in athletes 4. Determine the quantitative/qualitive of mixtures by various techniques. 11. List of Experiments (Student has to perform ten experiments) Instrumental Techniques 1. Safety Practices in the Chemistry Laboratory 2. Determination of the void volume of a gel filtration column. 5. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.) 6. Study of Electronic Transitions in Organic Molecules (i.e., acetone in water) 7. IR Absorption Spectra (Study of Aldehydes and Ketones) 8. Determination of a Chloride-Iodide Mixture 12. Cyclic Voltammertry of the Ferrocyanide/Ferricyanide Couple 13. Nuclear Magnetic Resonance of organic compounds	Course Objectives						1
 Introduce students to Safety Practices in the Chemistry Laboratory Explain various concepts of techniques for the identification of compounds. Learn the determination of a Mixture of Cobalt and Nickel using various techniques. Learn quantitative/qualitive analysis of mixtures by various techniques. Detection of illegal drugs or steroids in athletes Determine the quantitative/qualitive of mixtures by various techniques. Detection of pollutants or illegal dumping Detection of pollutants or illegal dumping Determine the quantitative/qualitive of mixtures by various techniques. It List of Experiments (Student has to perform ten experiments) Instrumental Techniques Safety Practices in the Chemistry Laboratory Determination of the isoelectric pH of a protein. Titration curve of an amino acid. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.) Study of Electronic Transitions in Organic Molecules (i.e., acetone in water) I. RAbsorption Spectra (Study of Aldehydes and Ketones) Betermination of Calcium, Iron, and Copper in Food by Atomic Absorption Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride) Separation of Carbohydrates by HPLC/Paper Chromatography Potentiometric Titration of a Chloride-Iodide Mixture Cyclic Voltammetry of the Ferroeyanide/Ferrieyanide Couple Nuclear Magnetic Resonance of organic compounds Mass spectrometry of organi compounds Mitps://www.youtube.com/watch?v=fiTEUEXICI https://www.youtube.com/watch?v=fiTEUEXICI https://www.youtube.com/watch?v=f	The objectives of this co	ourse are to:			e de la composición de	and the second	
 Explain various concepts of techniques for the identification of compounds. Learn the determination of a Mixture of Cobalt and Nickel using various techniques. Learn quantitative/qualitive analysis of mixtures by various techniques. Course Outcomes (COs) Upon successful completion of this course, the student will be able to; Perform various experimental to identification of compounds. Detection of pollutants or illegal dumping. Determine the quantitative/qualitive of mixtures by various techniques. I. List of Experiments (Student has to perform ten experiments) Instrumental Techniques Safety Practices in the Chemistry Laboratory. Determination of the isoelectric pH of a protein. Titration curve of an amino acid. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.). Study of Electronic Transitions in Organic Molecules (i.e., acetone in water) I. Rafety Practices of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride) Separation of Carbohydrates by HPLC/Paper Chromatography Potentiometric Titration of a Chloride-Iodide Mixture Separation of Carbohydrates by HPLC/Paper Chromatography Potentiometric Titration of a Chloride-Iodide Mixture Cyclic Voltanmetry of the Ferrocyanide/Ferricyanide Couple Nuclear Magnetic Resonance of organic compounds Detection of pollutants or illegal dumping Detetection of pollutants or illegal dumping Detect	. Introduce students t	o Safety Practices in	h the Chemistry Labo	oratory			
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 9. Quantitative Analysis of Mixtures by Gas Chromatography (i.e., [chloroform and carbon tetrachloride) 10. Separation of Carbohydrates by HPLC/Paper Chromatography 11. Potentiometric Titration of a Chloride-Iodide Mixture 12. Cyclic Voltammetry of the Ferrocyanide/Ferricyanide Couple 13. Nuclear Magnetic Resonance of organic compounds 14. Mass spectrometry of organi compounds 15. Detection of illegal drugs or steroids in athletes 16. Detection of pollutants or illegal dumping 12. Brief Description of self-learning/ E – learning component 1. https://www.youtube.com/watch?v=fjiTEUEXfCl 2. https://www.youtube.com/watch?v=3zAHebLMyI4&list=PLrTvGdxJHsrjro2FT2DyHULMbpCl 0T&index=3 14. https://www.youtube.com/watch?v=C1PamK587zg&list=PLrTvGdxJHsrjro2FT2DyHULMbpCl 0T&index=6 13. Books Recommended 2. Svehla, G. Vogel's Quantitative Inorganic Analysis, Pearson Education, 2012, ISBN, 978-8131773710. 2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009, ISBN 9788131723258. 3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011), ISBN 978-81-265-3016-8. 4. B Viswanathan, PS Raghavan, Practical Physical Chemistry, Viva Books, ISBN 978-8130929699. 	8. Determination of	f Calcium. Iron. and	d Copper in Food by	Atomic Abso	rption		
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 https://www.youtube.com/watch?v=fjiTEUEXfCI https://www.youtube.com/watch?v=d8DftLa3m5M https://www.youtube.com/watch?v=3zAHebLMyI4&list=PLrTvGdxJHsrjro2FT2DyHULMbpCl 0T&index=3 https://www.youtube.com/watch?v=C1PamK587zg&list=PLrTvGdxJHsrjro2FT2DyHULMbpCl 0T&index=6 Books Recommended Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012, ISBN, 978- 8131773710. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009, ISBN 9788131723258. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011), ISBN 978-81-265-3016-8. B Viswanathan, PS Raghavan, Practical Physical Chemistry, Viva Books, ISBN 978- 8130929699. 	2. Brief Description of	self-learning/ E –	learning componen	t			
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 https://www.youtube.com/watch/v=CTPamK38/2g&fist=PLrTvGdxJHsrjro2FT2DyHULMbpCf 0T&index=6 Books Recommended Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012, ISBN, 978- 8131773710. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009, ISBN 9788131723258. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011), ISBN 978-81-265-3016-8. B Viswanathan, PS Raghavan, Practical Physical Chemistry, Viva Books, ISBN 978- 8130929699. 	bttps://www.voutub.	a ann huatah 9 - C11	Dame V 507-2 0 1: 4-DI	T O 1 U I '	ADTAD		
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 Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009, ISBN 9788131723258. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011), ISBN 978-81-265-3016-8. B Viswanathan, PS Raghavan, Practical Physical Chemistry, Viva Books, ISBN 978- 8130929699. 	8131773710	Quantative morgan	ine Analysis, Pearso	n Education,	2012, 15	BN, 9/8-	
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1. Name of	the Dep	artment: Mathe	ematics	and a straight of							
2. Course I	2. Course Name Analysis-II L T P										
3. Course (Code	17030809	4	0 0							
4. Type of	Course (use tick mark)	Core ()	DSE ()	AEC ()	SEC O	OE ()				
5. Pre-requ (if any)	isite		6. Frequency (use tick	Even	Odd ()	Either Sem	Every Sem()				
7. Total Number of Lectures, Tutorials, Practical											
Lectures = 52 Tutorials = 0 Practical = 0											
8. Course I	Descripti	ion:									
This course of will be taught the sequence In this course in the course	This course covers some fundamental topics of mathematical analysis. In this course the students will be taught Riemann and Riemann-Stieltjes integral, pointwise and uniform convergence of the sequence and series of functions. In this course the students will be taught and theory of functions of complex variables, discussed in the course are analytic and harmonic functions and their properties, power series and Laurent										
series, isolate	d singula	arities.									
9. Course	Objectiv	ves:									
After comple	ting this	course, students	will be able:								
 To u conse To st funct To st value To st To st To st To st After comple 	nderstan quences. udy poin ons. udy anal d functio udy bilin Dutcome ting this	d the concept of twise and unifor ytic function, Ca on. ear transformatio s (COs): course, students	of Riemann and Rei m convergence of the auchy residue theorem n, integral function an will be able:	mann-Stie e sequence n, evaluation d related r	Itjes integ and serie on of integ esults.	ral and s of real gral of co	related valued				
 To dem To solve To unde To idem 	e probler rstand th tify singu	the ability to wor ns based on point the concept of Cau alarity using pow	k with Riemann-Stielt t wise and uniform cou ichy's residue theorem er series expansion.	jes integra nvergence n and evalu	ls. of sequence nation of in	ces of fur tegrals.	ctions.				
11. Unit wise detailed content											
Unit – 1	Numbe	er of lectures =	Title of the unit: I	Riemann I	ntegral						
Partition of a variable, Inte by parts, Firs	Partition of a set, Upper and lower sum, Riemann integral, Properties of the integral, Change of variable, Integration and differentiation, Fundamental theorem of integral calculus, Integration by parts, First and second mean value theorems for Riemann integrals.										
Unit – 2	Numbe	er of lectures =	Title of the unit: S	Sequences	and Serie	s of Fun	ctions				
Point wise an convergence, uniform con approximatio	nd unifor Differen vergence n theoren	rm convergence ntiation and inte of series of m.	of sequences of func gration of sequence/se functions, Weierstrass	tions, Cau eries of fu s M-test,	chy criteri inction, Co Abel's te	ion for u onvergen est, Weie	niform ce and erstrass				

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Unit – 3	Number of lectures =	Title of the unit: Cauchy's Theorems and
	13	Fundamental Theorem of Algebra
Anti-derivati	ves, Proof of anti-derivati	ve theorem, Cauchy-Goursat theorem, Cauchy integral
formula, An	extension of Cauchy integ	ral formula, Consequences of Cauchy integral formula,
Liouville's th	neorem, Fundamental theore	em of algebra.
Unit – 4	Number of lectures = 13	Title of the unit: Power Series
Convergence	of sequences and series,	Taylor series and its examples, Laurent series and its
examples, A	Absolute and uniform co	onvergence of power series, Uniqueness of series
representatio	ns of power series, Isolate	d singular points, Residues, Cauchy's residue theorem,
residue at inf	inity, Types of isolated sing	gular points, Residues at poles and its examples.
12. Brief De	scription of self-learning /	E-learning component
1. <u>https://w</u>	ww.youtube.com/watch?v=	-xPyy2uSzKjU
2. <u>https://w</u>	ww.youtube.com/watch?v=	5nlHi09HmrA
13. Books R	ecommended	
1. T.M. Apo	ostol: Mathematical Analys	is, Narosa Publishing House (2 nd ed.), 2002.
2. R.R. Gol	dberg: Methods of Real Ana	alysis, Oxford & IBH publishing Co., 2020.
3. D. Soma	sundaram and B. Choudha	ary: A First Course in Mathematical Analysis, Narosa
Publishin	ig House, 1997.	
4. Shant Na	arayan: A Course of Mather	matical Analysis, S.Chand & Co,2005.
5. Shanti Na	arayan: Theory of Functions	s of a Complex Variable, S. Chand & Co, 2005.
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1. Name of the	Department: Math	ematics						
2. Course	Algebra-II	L	(Γ		P		
Name								
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3. Course	1/030810	4		0	0			
4 Type of Cour	an (use tick	Carro		AECO	SEC 0	OFO		
4. Type of Cour mark)	se (use lick	Core	DSE ()	AEC ()	SEC ()	OF ()		
5. Pre-	1	6 Frequenc		Odd ()	Fither	Every		
requisite		v	Even ()	Oud ()	Sem ()	Sem ()		
(if any)		(use tick						
		marks)						
7. Total Numbe	r of Lectures, Tute	orials, Practical						
Lectures $= 52$		Tutorials =	0 P	ractical = 0				
8. Course Descr	iption:			1				
This course cove	ers group actions,	Sylow's theore	ms, solvabl	e groups, r	nodule the	eory and		
Galois fields. It f	urther covers diago	onalizability, spe	ctral decom	position, sp	ectral theo	orem and		
Jordan canonical	form of matrices.							
9. Course Obje	ctives:							
After the complet	ion of the course, st	udents will be ab	le:					
1 To identify	and construct over	malas of modulos						
		inples of modules						
2. To use the	skills of abstract al	gebra in solving o	lifferent typ	es of proble	ms.			
3. Classify fin	nite fields using roo	ts of unity and G	alois theory					
4. To underst	and the concepts of	solvable groups,	nilpotent gr	oups etc.				
10. Course Outco	omes (COs):				1			
A.Q. 1.4								
After completing	the course, students	are expected to I	be able:					
1. To solve the	e problem of nilpote	ent groups, field t	heory and fi	nite fields.				
2. To demonst	rate the importance	of algebraic prop	perties.					
3. To define an	nd characterize the	Notherian Artini	an module					
1 To apply the	a techniques of line	ar algabra to calu	a different "	no la la mara				
4. 10 appry th	e techniques of nine	al algebra to solv	e different p	roblems.				
II. Unit wise deta	ailed content		C 1					
Unit-1 Num	ber of lectures $= 15$	Sylow's The	orem, Solva	able and Ni	lpotent Gi	roups		
Group actions, Cla	ass equation of grou	ups, Cauchy's the	corems for a	belian and n	ion-abeliar	n groups,		
Sylow's theorems	s for abelian and	non-abelian gro	oups, Appli	cations of	Sylow's 1	theorem,		
Solvable groups,	Maximal subgroup	s, Composition s	series of a g	roup, Jorda	n-Hölder	theorem,		
abelian groups,	Direct product and	semi-direct prod	luct of group	os, Structure	theorem i	tor finite		
abenan groups.			~	1	1.1.1			
Unit – 2 Numl	ber of lectures $= 12$	Ideals, Field	s, Galois fie	elds				
Ideals (principle,	prime and maxima	l) and quotient ri	ings, Euclide	ean rings, E	Luclidean d	lomains,		
Principal ideal do	mains (PID), Uniq	ue factorization	domain, Fie	eld of quotion	ents of an	integral		
uomain, Field, F	inite fields, Field	extensions, Galo	ois field an	d its applie	cation to	classical		
problems.			1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1					
Unit – 3 Numb	per of lectures $= 12$	Module The	ory		1			
	~ 0 (in			1			
dal lat	mar		latt					
Vor			A					
/								



Modules, Definition and examples, Submodules, Direct sum decomposition, Free modules, Quotient modules, Simple modules, Modules over PIDs, Modules with chain conditions, Artenian modules, Noetherian modules, Hilbert's basis theorem.

Unit – 4 Number of lectures = 13 Linear Algebra

Diagonalizability, Application of eigenvalues, Least square approximations, Orthogonal projection, Spectral theorem and its applications, Singular value decomposition and pseudo inverses, Spectral decompositions and spectral theorem, Applications of spectral theorem, Primary decomposition theorem, Jordan canonical form, Minimal polynomials.

12. Brief Description of self-learning / E-learning component

- 1. https://www.youtube.com/playlist?list=PLEAYkSg4uSQ1Yhxu2U-BxtRjZElrfVVcO
- 2. <u>https://www.youtube.com/watch?v=HHyBTlUJyF0&list=PLY2U8CcmALO4HqPsKdghs0</u> JMy0HUL7TLs
- 3. <u>https://www.youtube.com/watch?v=LJ-</u> LoJhbBA4&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7

- 1. I.N.Herstein: Topics in Algebra (2nd ed.), Wiley Eastern Ltd., New Delhi, 1975.
- 2. P. B. Bhattacharya, S.K. Jain and S.R. Nagpaul: Basic Abstract Algebra (2nd ed.), Cambridge University Press, 2003.
- 3. P.M. Cohn: Algebra, Vol-1, I. John Wiley, 1991.
- 4. I.S. Luther and I.B.S.Passi: Algebra. Vol.-1, Narosa Publishing House, 1990; 1996.
- 5. D.S. Malik, J.N. Mordenson and M.K. Sen: Fundamentals of Abstract Algebra, International ed. McGraw-Hill, 1997.

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1. Name	of the l	Department: Ma	them	atics						
2. Course	e	Mathematical		L		Т			P	
Name		Programming								
2 Course	•	17020911	2	4		0	1		0	
S. Course Code	e	17030811					U			
4. Type of	of Cour	se (use tick	Co	re ()	DSE (~	AEC ()	SEC	OE ()	
mark)					DDL (•)		0		
5. Pre-			6.	Frequency	Even (X	Odd ()	Either	Every Sem	
requis	ite			(use tick		• /		Sem	0	
(if any	y)			marks)				0		
7. Total	Numbe	r of Lectures, Tu	itoria	als. Practical						
Lectures =	= 52	i of Lectures, it		Tutorials = 0	7	Pra	ctical = 0			
			1			1				
8. Course	e Descr	iption:	0.000	like negliger			a aa-1 -			
no gramm	ing and	unconstrained	areas	nike nonlinear	program	nmin	g, goal pr	ogrammi	ng, stochastic	
analysis A	hove a	reas define vario	optil	eorems and teal	iques, t	for m	of progra	al world	and network	
methods to	find th	eir optimal soluti	on on	coremis and teer	inques		iouening re	al world	problems and	
incento do te	/ mid th	en optimier soluti	UII.							
9. Course	e Obje	ctives:								
1. To	explain	nonlinear progra	mmi	ng with equality	and ine	quali	ty constrai	nts.		
$\begin{array}{c} 2. \text{Ex} \\ 3 \text{To} \end{array}$	plain qu	adratic programn	ning,	convex program	nming a	nd se	parable pro	ogrammi	lg.	
D. TO	RT-CPI	M.	vitii t	ne network sing	JIEX IIICI	mou,	project pla	inning an	a control with	
4. Lea	arn class	sical optimization	tech	niques and num	erical m	nethod	ds of optim	ization.		
10. Course	e Outco	omes (COs):								
After com	pleting t	this course, studen	nts w	ill be able:						
1 To	underst	and the basics of	ontin	nization models						
2. Ab	ility to a	apply the theory of	ofopt	timization methodels	ods and	algor	ithms to de	evelop ar	d for solving	
var	ious typ	bes of optimizatio	n pro	blems.		0				
3. For	rmulate	and solve nonline	ear pr	ogramming pro	blems.					
4. And	alyze j	problems with	goal	programming,	stochas	stic	programm	ing and	optimization	
	iniques									
II. Unit w	Num	ailed content	15	Title of the	it. Nor	line				
Unit-1	Tunn	oer of lectures =	15	The of the ut	nt: Non	-nne:	ar progra	mming		
Lagrangian	n functio	on Constrained a	nd u	nconstrained or	timizati	on N	Ion-linear	nrogram	ningproblems	
(NLPP) w	with equ	uality constraint	s. N	LPP with inec	mality	const	raint Kul	n-Tucke	er conditions	
Quadratic	program	nming, Convex pr	ogra	mming.	laundy	Jonst	Tunt, IXu	In TUCK	conditions,	
Unit 2	Num	hon of last	10	Title of the	it. C.	ID		-		
Unit - 2	Tumi	ber of lectures =	10	The of the ur	int: Goa	I Pro	gramming	5		
		~ 0	0	1	•			/	,	
.1.	h	ho	d	s n		ar			1	
W	1		/		X	2		c. S	Lette .	



General goal programming models, Model with single goal, Model with multiple goals-equally ranked, Model with multiple goals-priority ranked, Graphical method of goal programming, Simplex method in goal programming.

Unit – 3

Number of lectures = 15Title of the unit: Stochastic Programming and
Unconstrained Optimization Techniques

Chance constrained programming technique, Stochastic linear programming, Stochastic non-linear programming, Two stage programming technique, Rate of convergence, Direct search method, Indirect search method.

Unit – 4 Number of lectures = 12 Title of the unit: Network Analysis

Shortest path problems, Minimum spanning tree problems, Maximum flow problems, Minimum cost flow problems, Network simplex method, Project planning and control with PERT-CPM.

12. Brief Description of self-learning / E-learning component

- 1. https://nptel.ac.in/courses/111105039
- 2. <u>https://www.youtube.com/watch?v=Tm2HhqMu5Jg</u>
- 3. https://nptel.ac.in/courses/111107104

- 1. Singiresu S. Rao: Engineering Optimization-Theory and Practice (3rd ed.), New Age International Publishers, 2013.
- 2. A. Ravindran, K. M. Ragsdell and G. V. Reklaitis: Engineering Optimization-Methods and Applications (2nd ed.), Wiley-India Edition, 2006.
- 3. Kanti Swarup, P.K. Guptaand Man Mohan: Operational Research, Sultan Chand and Sons New Delhi, 2010.
- 4. Z.S. Kambo: Mathematical Programming Techniques, East West Press, 1997.
- 5. Suresh Chandra, Jayadeva, Aparna Mehra, Numerical Optimization with Applications, Alpha Science International Ltd., 2009.

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1. Name of the	e Department: M	athematics				
2. Course	Mathematical					
Name	Programming	L	T		P	
3. Course Code	17030812	0	0		4	
4. Type of Cou mark)	urse (use tick	Core ()	DSE ()	AEC 0	SEC ()	OE ()
5. Pre- requisite (if any)		6. Frequency (use tick marks)	Even (Odd ()	Either Sem ()	Every Sem ()
7. Total Numb	per of Lectures. T	utorials, Practical				<u> </u>
Lectures = 0	,, _	Tutorials = 0		Practical	= 52	
8. Course Des	cription:		States March			
real-world probl theories to solv subject to constr 9. Course Obj	lems by using mat e these real-work raints of time, labo ectives:	hematics, statistics, a d problems by finding r, resource, material,	and compute ng the optimisand busines	ers. It pro mal solut is rules.	vides you to ions to the	e models
decision making problems.	; model formulati	ion and applications t	that are used	d in solvi	ng decision	n making
10. Course Out	comes (COs):	· · ·				
On successful co Solve the proble	ompletion of this c m with software l	ourse, students will b ike (LINGO, MAPLE	e able to: , Mathemat	ica. MAT	LAB),	
11. List of Prac	tical's (using any	one from C++, MA	TLAB)			-
1.Problems2.Problems3.Problems4.Problems5.Problems6.Problems7.Problems8.Problems9.Problems10.Problems11.Explain the12.Solve the13.Find the14.Solve the	s on LPP by Simp s on LPP by Revis s on Networking. s on General goal s on Dynamic Pro- s on Monte Carlo s on Monte Carlo s on Minimum Spa s on Maximum Fla s on Minimum Co s on Network Simp the application of 1 e shortest path by Minimum Spanning	lex Method. ed Simplex Method. gramming. Simulation. anning Tree problems ow Problems. st Flow Problems. plex Method. Nonlinear Programmi using PERT and CPM ng Tree on MATLAB by using PERT and C	ing on any N 1. CPM.	Mathemat	ical softwa	re.
Kongh	mal	ili.	Jest	2	c.S.	Lalite



12. Brief Description of self-learning / E-learning component

1. https://www.youtube.com/watch?v=qTJDNXRfcsc

2.https://in.mathworks.com/matlabcentral/answers/97605-are-there-any-examples-showing-how-to-perform-monte-carlo-simulation-in-matlab

3. https://www.youtube.com/watch?v=M mpRrGKKMo

4. http://www.digimat.in/nptel/courses/video/111105100/L31.html

- 1. F.S. Hillier and G.J. Leiberman: Introduction to Operations Research (10th edition), McGraw – Hill International Edition. This book comes with a CD containing tutorial software, 2017.
- 2. P. Venkataraman: Applied Optimization with MATLAB Programming (2nd edition), John Wiley & Sons Inc, 2009.
- 3. SukantaNayak: Fundamentals of Optimization Techniques with Algorithms, Academic Press, 2020.
- 4. S.S. Rao: Optimization Theory and Applications, Wiley Eastern Ltd, New Delhi, 1984.

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2. Course Name	Soil and wat	er pollution	L	Т	Р	Credits
. Course Code	17030813		4	0	0	4
. Type of Course ark)	(use tick	Core()	DSE(✓)		SEC()	
. Pre-requisite if any)	10+2	6.Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem()
. Total Number o	of Lectures, 7	Futorials , Practical	(assuming 15 w	eeks of o	ne semester))
ectures=52 Course Descript	tion:	Tutorials=Nil	Pra	ctical=Nil		
The course mainly ike soil profile, pl oil. It also includes ecycling, compost This also aware properties of wa	covers the so nysic-chemica s solid waste a ing, vermin- s students ter and diff	bil and water pollut al properties of soil and its management composting, inciner about the vario ferent treatment r	ion problems and , soil pollution a using different r ration, energy re us factors aff methods for ir	d solution and reme nethods su ecovery fi fecting ndustrial	. This cover diation of co uch sanitary rom organic the physic and domes	s the topics ontaminated land-filling, waste etc. ochemical stic waste
9. Course Objec	tives:				<u> </u>	
he objectives of this	s course are:					
To learn the basi	c concepts of	soil formation and i	mportant physic-	-chemical	properties.	
To know about the	ne remedial m	neasures for soil poll	ution.			
. To provide know	ledge about t	he different methods	s of solid waste r	nanageme	ent.	
. To develop under	rstanding of v	vater quality criteria	and standard.			
To describe the v	vaste water tre	eatment processes.				
). Course Outcom	es(COs):					
pon successful com	pletion of this	s course the student	will be able			
To know about th	ne various phy	vsicochemical prope	erties of soil and	maior sou	rces of soil n	ollution
To understand an	d apply the co	oncept of solid wast	e management to	minimiz	e the adverse	offects
To be familiar wi	th relationshi	ns between inapprov	riate waste man	agement r	reations and	their impost
on water and soil	in relationshi	ps between mapping	onate waste man	agement p	nactices and	men mpact
To develop an int	tegrated perch	active on water ress	wroos and water	avality an		
To understand the	different we	ste weter treatment	burces and water	quanty m	anagement.	
10 understand the	different wa	ste water treatment	methodologies.			
nit-1 Number Soil Formation: Proc of soil, Soil pollution	er of lectures cess, Factors, on: Types an	=13 Soil profile, Types d major sources o	Soil format of soils, Physico of soil pollutan	ion an d p chemical ts, effect	oroperties and biologics s of soil po	al properties ollutants on
nit_2 Numbe	nai measures	= 13	Solid wests	and its w	101000000	
Solid waste: Source	s, classificati	ion & composition	Solid Waste N	Manageme	nanagement ent-Sanitary	land-filling.
Recycling, Compos	ting, Vermi-	composting, Incine	eration, Energy	recovery	from orga	anic waste-
astrication, Liquiti	cation and P	yrolysis, Waste m	inimization tech	nologies,	HazardousV	Vasteand its
Qreat of	fron	Louguel by	ps v	6.202	-	Latt

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Management

Number of lectures=13 Water properties and resources Unit-3 Physico-chemical and biological properties of fresh water, Hydrological cycle, Solubility of gases in water, carbonate system, Water management strategies: Rain water harvesting, Recharging of ground water, Water quality standards.

Unit-4 Number of lectures=13 Water pollution

Water pollution: Sources, causes and effects, Characteristics of domestic, industrial and agricultural waste water, Marine pollution, Thermal pollution. Primary, secondary, tertiary & advance treatment of waste water, Wastewater treatment technologies, Bioremediation, Water borne diseases.

- 12. Brief Description of self learning/E-learning component
- 1. https://www.environmentalpollutioncenters.org/soil 2. https://www.springer.com/journal/11270
- http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P000280/M026065/ET/152050 3. 5536paper10 module25 etext.pdf

13. Books Suggested:

- Introduction to Soil Microbiology by. Alexander, M., Publisher: John Wiley & Sons, ISBN-13 : 978-1. 0471021797
- 2. Fundamentals of Soil Ecology by Coleman and Crossley, Academic Press, ISBN 9780121797263.
- 3. Soil Ecology, Killham, K., Cambridge University Press, ISBN: 9780511623363
- 4. Environmental chemistry by G.S.Sodhi, ISBN-13: 978-1842650127
- Introduction to environmental engineering and science Gilbert Masters, Publisher: Pearson, 5. ISBN-10:0134830660
- Water supply engineering by S.K. Garg, Publisher: Khanna, ISBN-13 : 978-8174091208 6.

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1.Name of the D	epartment: Environn	nental Science				
2. Course Nam	e Soil and water pol	lution	L	Т	Р	Credits
	-Lab					
3. Course Code	17030814	9	0	0	4	2
4. Type of Cou	rse (use tick mark)	Core()	DSE(~)	0.110	SEC()	
5. Pre- roquisite(if	10+2.	o.Frequenc	Ever	Odd()	Either	Every
any)		marks)			Sem()	Sem()
7. TotalNumbe	rofLectures, Tutorial	s,Practical(ass	uming15week	sofonesemest	er)	
Lectures=Nil	Τι	utorials=Nil	Pr	actical=52	,	
8. Course Desc	ription:					
This Course wi	Il introduce the stud	lents to the bas	sic concept o	of water pollu	tion and o	chemistry
This course wil	l also give a platfor	m to develop a	different met	hods to study	to variou	s samples
of water from a	torious sources Thi	a Carrier mill	alas lata da			
of water from v	various sources. This	s Course will	also introduc	e the student	is to unde	rstand the
basic chemistry	of the soil. To kno	w the method	ology for an	alysis of basi	c physico	-chemica
properties of so	il. To understand the	e solid waste a	nd its enviro	mental impli	ications	
	in the interstand the	Jona Haste a		montur mpn	outions,	
9. Course Ob	this course area					
The objectives of	uns course are:					
To explain the	e process of compostin	g/ Vermi-compo	osting/landfill.			
. To determine	DO, BOD, COD of w	astewater.				
. To compare p	hysio-chemical proper	rties of polluted	and non-polly	ited soil		
T		·		ated son.		
. To measure sp	pecific gravity and mo	isture content o	f soil.			
0.0	(22)					
10. Course Outc	omes(COs):					
Jpon successful c	completion of this cour	rse, the student	will be able:			
I. To understand	d the physio-chemical	properties of so	oil.			
7 To understand	d the physio-chemical	properties of w	ater			
. To understand	a the physio-enemical	properties of w	ater.			
3. To be familia	r with composting/ver	micomposting/l	landfill sites.			
. To understand	d the process of waste	water treatment	t.			
11.List of Expe	riments		· · · · · · · · · · · · · · · · · · ·			
. A visit to com	posting/vermicompost	ting/sanitary lan	dfill site and r	eport writing.		
. A visit to near	by STP/ETP to unders	stand operation	and report wri	ting on process	s of water/	effluent
treatment.						
Determination	of pH and Electrical	ination of moist	ture content of	the soil.		
Determination	of hardness of water	sample	Son and wate	er sample.		
Determination	of the alkalinity of wa	ater sample.				
Estimation of I	Dissolved Oxygen of	water sample.				
Estimation of I	Biological oxygen Der	mand of wastew	vater.			
Estimation of	Chemical oxygen dem	and of wastewa	iter.			
0. To determine of	organic carbon content	t in soil sample.			San Shall	
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	1.0					
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Brief Description of self learning/E-learning component

- 1. https://www.environmentalpollutioncenters.org/soil/
- 2. https://www.springer.com/journal/11270
- 3. <u>http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P000280/M026065/ET/152050</u> 5536paper10_module25_etext.pdf

Books Suggested:

-

- Introduction to Soil Microbiology by.Alexander, M., Publisher: John Wiley & Sons, ISBN-13 : 978-0471021797
- 2. Fundamentals of Soil Ecology by Coleman and Crossley, Academic Press, ISBN 9780121797263.
- 3. Soil Ecology, Killham, K., Cambridge University Press, ISBN: 9780511623363
- 4. Environmental chemistry by G.S.Sodhi, ISBN-13: 978-1842650127

5. Introduction to environmental engineering and science - Gilbert Masters, Publisher: Pearson, ISBN-10:0134830660

Water supply engineering by S.K. Garg, Publisher: Khanna, ISBN-13 : 978-8174091208

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1. Name of the De	partment: Envir	onmental Science	e			
2. Course Name	EIA and Sustain	able development	L	Τ	Р	Credits
3. Course Code	17030815		4	0	0	4
4. Type of Course	(use tick mark)	Core ()	DSE (✓)		SEC ()	1
5. Pre- requisite(if any)	10+2	6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number o	of Lectures, Tuto	orials, Practical (a	ssuming 15	weeks)		
Lectures $= 52$		Tutorials = Nil		Pra	ctical = Nil	
8. Course Descript	tion:					
This course will intr	oduce students to	the concept of en	vironmental i	mpacts asses	sment and i	ts importance.
ilso help students in	n understanding t	he various method	lologies and	guidelines of	EIA in deta	ails. This cour
also covers the diffe	erent stages of El	IA, criteria and sta	undards for th	e environme	ntal impact	assessment a
provides the alterna	tes and mitigation	n measures to redu	ice the adver	se impacts of	developme	ental projects
environment. Last ty	wo units of this c	ourse covers the to	pics such as	Principles and	d emergenc	e of the cone
of Sustainable Deve	lopment, Resource	ce degradation, so	cial insecurity	v and Role of	developed	countries in t
sustainable develop	nent of developir	a countries	orar misecurry		developed	countries in t
Course Objectiv	ast				<u></u>	
The objectives of thi	s course are:					
. To acquaint stude	nts about the con	cept and basic pro	cess of enviro	onmental imp	act assessm	ent
2. To develop critica	l awareness amo	ng students about	the factors af	fecting the EI		ient.
To describe the F	A methodologie	and rick assessm	ant process	leeting the Ei	A process.	
To know the princ	viple of sustainab		em process.			
To know the princ	cipie of sustainab	le development.				
o. To understand the	future aspect of	sustainability.				
0. Course Outcom	es (COs):					
Jpon successful con	npletion of this co	ourse, the student v	vill be able:			
1. To identify t	he environmenta	l attributes to be co	onsidered for	the EIA study	y.	
2. To formulate	e objectives of the	e EIA studies.				
3. To identify t	he methodology	to prepare rapid El				
4. To prepare F	IA reports and er	vironmental man	agement nlan	C		
5 To get basic	knowledge show	concert of sust :	agement plan			
Init wise detailed a	antont	concept of sustain	lable develop	oment.		
Init-1 Nur	ber of lectures =	= 13	Introduction	to FIA Con	cent	
			ind outerion		cept	
lature and purpose of	A notification 10	npact assessment,	Environment	tal impact sta	tement and	Environment
invironmental cleara	ince. Compositio	94,2006&2020.1 n of FAC & SEAC	TA checklist	, ISO14000 ai	nd Life cycl	es Assessmen
	, compositio	a of Line & SEA				

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Unit – 2	Number of lectures = 13	Process an	nd Methods of EIA	\:
EIA mathada				
DIA methodo	d mitigation Criteria and standard of	, Base-line data	a, Impact Identifica	tion, Impact prediction
evaluation of	Environmental Impacts Dublic Det	assessing sign	ificant Impact. Cos	t- Benefit Analysis and
auditing	Environmental impacts. Public Parti-	cipation, prese	ntation and review	7. EIA monitoring and
Unit _ 3	Number of lectures – 13		Compared a C.C. d	• • • • • •
onne – 5	Number of feetures = 15		Concept of Susta	inability
Sustainable D	evelopment: Concept, principles and i	indicators, SDC	Gs, Agenda for Fut	ure Global Sustainable
Development	Role of developed countries in the	he sustainable	development of	developing countries
Demographic	dynamics and sustainability, Integrated	d approach for	resource protection	and management.
Unit – 4	Number of lectures = 13		Approaches	for Sustainable
			Development	
Environmenta	l accounting for sustainable developm	ent, Clean dev	elopment mechanis	sm and carbon trading
Green building	g concept, Linkages between populatio	n, poverty and	environment, Role	of public in sustainable
levelopment,	National Environment Policy 2006, R	ecent initiative	s of renewable ene	rgy by Government or
ndia,				
1. Brief Des	cription of self-learning / E-learning	component		
. <u>https://ww</u>	w.iitr.ac.in/wfw/web_ua_water_for_w	velfare/education	on/Teachers Manua	l/Teacher manual ma
ster_EIA.j	pd1 w jitt po in			
https://ww	w.nu.ac.m	velonment_ren	ort_2021/	
https://ww	/w.un.org/sustainabledevelopment/prog	gress-report/	011-2021/	
2. Books Re	commended			
. Environme	ental Impact Assessment by John Glass	son, Publisher:	Routledge, ISBN	9781138600744.
. Methods o	f Environmental Impact Assessment by	y Morris and th	ne rivel. Publisher:	Routledge, ISBN:
Fnvironme	ontal Impact Assessment by I. W. Can	tor Dublishory	MaCaser II'll II'	
edition. IS	BN-13 : 978-0070097674	ter, rubiisher.	McGraw-Hill High	her Education; 2nd
. The Sustai	nability Revolution: Portrait of a Parad	ligm Shift by E	dwards, Andres R.	Publishers: New
Society, IS	SBN-13 : 978-0865715318			,
. Sustainable	e development in India: Stocktaking in	the run up to I	Rio+20: Report prej	pared by TERI for
MoEF, 201	11. he Department for D-line Counting	10	1	
Nations Di	vision for Sustainable Development	n and Sustainat	ble Development (I	DPCSD), United
Nations Di	Vision for Sustainable Development.			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

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DU AUXINESS AND DURATING AND ADDRESS	EIA and Sustaina	ble Development-		L	Т		Р	Cred
3. Course Code	17030816			0	0		4	2
4. Type of Course (u	ise tick mark)	Core ()		DSE (✓)	SEC ()		-	
5. Pre-requisite (if any)	10+2	6. Frequency (use marks)	tick	Even (✓)	Odd ()	Eithe	r E O S	Every Sem ()
7. Total Number of Lectures = Nil	Lectures, Tutoria	s, Practical. Tutorials = Nil		Practical:	= 52			
					52			
Course Description	n:		0.777					
his Course will intro	duce the students t	o the basic concept of	of EIA	A, EIS, regul	atory auth	orities	in Indi	ia relate
o projects. The part of	Sustainable Deve	lopment will enable	stude	nts to unders	tand the in	mporta	nce of	natura
esources and the need	for their conserva	tion. This course wi	ll also	give a platf	orm to dev	velop k	nowled	dge abo
he requirements, chec	k lists, process and	time need for decis	ion m	aking in pro-	ceedings c	of any p	roject	s.
. Course Objective	s:							
0. Course Outcomes pon successful comp	(COs): letion of this cours	e, the student will be	able:	<u></u>				
Identify the factors a	affecting the EIA P	rocess.						
 Identify the factors a Prepare the EIA repare Demonstrate the me 	affecting the EIA P ort of different proj thods for carrying o	rocess. lects. out impact assessme	nt me	thod				
 Identify the factors : Prepare the EIA rep Demonstrate the me Develop the strategi List of Experiment 	affecting the EIA P ort of different proj thods for carrying o es to conserve natu s	rocess. ects. out impact assessme ral resources	nt me	thod			3	

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- 1. Environmental Impact Assessment by John Glasson, Publisher: Routledge, ISBN 9781138600744.
- Methods of Environmental Impact Assessment by Morris and the rivel. Publisher: Routledge, ISBN: 9781134107988
- 3. Environmental Impact Assessment by L. W. Canter, Publisher: McGraw-Hill Higher Education; 2nd edition, ISBN-13 : 978-0070097674
- 4. The Sustainability Revolution: Portrait of a Paradigm Shift by Edwards, Andres R., Publishers: New Society, ISBN-13 : 978-0865715318

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. Course Name LA	TEX Lab	L		T	1	P
					-	
Course Code				0	4	4
Type of Course (use tic	k mark)	Core ()	DSE (D)	AEC ()	SEC ()	OE ()
Pre-requisite		6. Frequency	Even (1)	Odd ()	Either	Every
(if any)		(use tick marks)			Sem ()	Sem (
. Total Number of Lectu	res, Tutoria	ls, Practical	1			
ectures = 0		Tutorials = 0	Prac	tical = 52		
. Course Description:						1.1.
his course introduces the b	asic concepts	s of LaTeX. Participan	ts taking thi	s course wil	l be able to	o create
nd design documents in La	Tex and pres	sentations in Beamer v	vith confide	nce.		
. Course Objectives:						
his course aims to introd	uce students	to use the typesettin	ng software	Latex to w	vrite Math	ematica
esearch articles, books etc.	It further exp	plains how to write co	omplex matl	nematical fo	rmulae, ta	bles in
ocument.						
0. Course Outcomes (COs	s):		12.			
fter completing this course	e students wil	l be able to:				
1. Use the beamer pack	age to create	presentations.				
2. Use BibTex to maint	ain bibliogra	phy information and to	o generate a	bibliograph	y for a par	ticular
document.	as of documo	nta				
4. Write complex mathe	ematical forn	nulae.				
1. Unit wise detailed conte	ent					
1. To create the first d	locument usir	ng LaTeX.				
2. To use different cla	sses like artic	cle, book, report and a	msarticle.			
3. To organize content	t into section	s using article and boo	k class.			
4. To use different ma	thematical pa	ackages.				
5. To change the form	atting of a la	tex document like head	der. footer.	margins, mu	ltiple colu	mns
6. To change formattin	ng of a text s	uch as style, size, colo	r. alignment			
7. To add bullets and r	numbering.		, 8			
8. To add images, exp	lore different	properties like rotate.	scale etc.			4
9. To create different t	types of table	es, arrays.				
10. To define a new env	vironment in	a LateX document.				
11. To write complex m	nathematical	structures.				
12. To write mathemati	ical equations	s in different environm	ents.			
13. To add references a	nd citations.					
14. To create a presenta	ation using th	e Beamer package.				
2. Brief Description of sel	f learning / 1	E-learning componen	t			
	lilé	g tomponen	<u> </u>		,	
Vort	relación	19	Q		/ etc	

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- 1. https://www.youtube.com/watch?v=0ivLZh9xK1Q&list=PL1D4EAB31D3EBC449
- 2. https://www.youtube.com/watch?v=bCumVPGR4ts&list=PL1D4EAB31D3EBC449&index=2
- 3. https://www.youtube.com/watch?v=kefvRACdXHs&list=PL1D4EAB31D3EBC449&index=3

- 1. LaTex Tutorial: A primary by Indian Tex users group
- 2. Stefan Kottwitz: LaTeX Beginner's Guide: Create visually appealing texts, articles, and books for business and science using LaTeX (2nd edition), 2021.
- 3. Leslie Lamport: LaTeX: A Document Preparation System, Addison- Wesley, 1994.

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