DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING COURSE STRUCTURE

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SYLLABUS-NRIA20

(Along with HONORS and MINORS)

(Applicable for batches admitted from 2020-2021)



NRI INSTITUTE OF TECHNOLOGY

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING <u>NRIA20 Course Structure</u> <u>I YEAR I SEMESTER</u>

S1. No	Course Code	Course Category	Title of the Course	L	Т	Р	Total Credi ts
1	20A1100101	HSC	Professional Communication	3	-	-	3
2	20A1100201	BSC	Engineering Mathematics-1	3	-	-	3
3	20A1100203	BSC	APPLIED Physics	3	-	-	3
4	20A1103301	ESC	ENGG. GRAPHICS	1	-	-	3
5	20A1105301	ESC	Programming and Problem Solving with C	3	-	_	3
6	20A1100292	BSC	APPLIED Physics Lab	-	-	3	1.5
7	20A1105391	ESC	Programming and Problem Solving with C Lab	-	-	3	1.5
			Т	OTAI	CRE	DIT	S = 18

Courses offered to other departments by EEE					
Basic Electrical & ElectronicsEngineering	CE				
Basic Civil and Electrical Engineering Workshop	CE				

Category	Credits		
Basic Science	7 5		
Course	7.5		
Engineering	7 5		
Sciences Course	7.5		
Humanities and			
Social Sciences	3		
Course			
TOTAL CREDITS	18		



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING NRIA20 Course Structure

<u>I YEAR II SEMESTER</u>

S1. No	Course Code	Course Category	Title of the Course	L	Т	Р	Total Credi ts
1	20A1200201	BSC	Engineering Mathematics-II	3	-	-	3
2	20A1200205	BSC	Applied Chemistry	3	I	I	3
3	20A1205302	ESC	JAVA Programming	2	-	-	3
4	20A1202401	ESC	Electrical Circuit Analysis-1	3	1	-	4
5	20A1201301	ESC	Basics of Civil & Mechanical Engineering	3	-	-	3
6	20A1200801	MC	Environmental Sciences	2	I	Ι	0
7	20A1200191	HSC	Communicative English	-	-	3	1.5
8	20A1200294	BSC	Applied Chemistry LAB	-	-	3	1.5
9	20A1201391	ESC	Basics of Civil & Mechanical Engineering Lab	-	-	3	1.5
10	20A1202491	ESC	Electrical Engineering Workshop	-	-	3	1.5
			Т	OTA	L CRI	DIT	S = 22

Courses offered to other departments by EEE					
Basic Electrical & ElectronicsEngineering	MECH				
Basic Electrical & ElectronicsEngineering lab	MECH				
Basic Electrical Engineering	ECE				
Basic Electrical Engineering lab	ECE				

Category	Credits		
Basic Science	7.5		
Course	1.5		
Engineering	12		
Sciences Course	13		
Humanities and			
Social Sciences	1.5		
Course			
Mandatory Course	0		
TOTAL CREDITS	22		





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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

NRIA20 Course Structure

II YEAR I SEMESTER

S1. No	Course Code	Course Category	Title of the Course	L	Т	Р	Total Credit s
1	20A2100201	BSC	Vector calculus, Fourier Transforms and Partial Differential Equations	3	-	-	3
2	20A2102401	PCC	Electronic Devices and Circuits	3	-	-	3
3	20A2102402	PCC	Electrical Circuit Analysis-II	3	-	-	3
4	20A2102403	PCC	DC Machines and Transformers	3	-	-	3
5	20A2102404	PCC	Electro Magnetic Fields	3	1	-	3
6	20A2102491	PCC	Electrical Circuits Lab	-	1	3	1.5
7	20A2102492	PCC	DC Machines and Transformers Lab	-	-	3	1.5
8	20A2102493	PCC	Electronic Devices and Circuits Lab	-	-	3	1.5
9	20A2102991	SC	Skill oriented course: Design of Electrical Circuits using Engineering Software Tools	-	-	4	2
10	20A2102802	МС	Professional Ethics & Human Values	2	-	-	0
TOTAL CREDITS = 21.5							

Category	Credits
Basic Science	3
Course	5
Professional Core	16.5
Courses	10.5
Skill advanced	
course/ Soft skill	2
course	
Mandatory Course	0
TOTAL CREDITS	21.5



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II YEAR II SEMESTER

S1. No	Course Code	Course Category	Title of the Course	L	Т	Р	Total Credit s
1	20A2205301	ESC	Python Programming	3	-	-	3
2	20A2202401	PCC	Digital Electronics	3	I	-	3
3	20A2202402	PCC	Power System-I	3	-	-	3
4	20A2202403	PCC	Induction and Synchronous Machines	3	-	-	3
5	20A2200101	HSC	Managerial Economics & Financial Analysis	3	-	-	3
6	20A2205391	ESC	Python Programming Lab	-	-	3	1.5
7	20A2202491	PCC	Induction and Synchronous Machines Lab	-	-	3	1.5
8	20A2202492	PCC	Digital Electronics Lab	-	-	3	1.5
	TOTAL CREDITS = 19.5						

Category	Credits		
Engineering	15		
Science Course	+.5		
Professional Core	10		
Courses	12		
Humanities and			
Social Sciences	3		
Course			
TOTAL CREDITS	19.5		



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

NRIA20 Course Structure III YEAR I SEMESTER

S1. No	Course Code	Course Category	Title of the Course	L	Т	Р	Total Credit s
1	20A3102401	PCC	Power Systems-II	3	-	-	3
2	20A3102402	PCC	Power Electronics	3	-	-	3
3	20A3102403	PCC	Linear Control Systems	3	-	-	3
4	20A3100601	SC	Soft Skill Course: Employability Skills Aptitude and Reasoning	3	-	-	3
5	20A3102511	PEC	Professional Elective – I: Utilization of Electrical Energy	3	-	-	3
6	20A3102491	PCC	Control Systems Lab	-	-	3	1.5
7	20A3102492	PCC	Power Electronics Lab	-	-	3	1.5
8	20A3102991	SC	Skill oriented course : IoT Lab	-	-	3	2
9	20A3102791	PROJ	Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester)	-	-	-	1.5
			TOTAL	CR	EDI	TS	= 21.5
		I	Minors Course	4	0	0	4
	Honors Course 4				0	0	4

Category	Credits			
Professional Core	12			
Courses	12			
Professional	2			
Elective Courses	3			
Skill advanced				
course/ Soft skill	5			
course				
Summer Internship	1.5			
TOTAL CREDITS	21.5			



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING NRIA20 Course Structure

III YEAR II SEMESTER

S1. No	Course Code	Course Category	Title of the Course	L	Т	Р	Total Credit s
1	20A3202401	PCC	Microprocessors and Microcontrollers	3	-	-	3
2	20A3202402	PCC	Electrical Measurements and Instrumentation	3	-	_	3
3	20A3202403	PCC	Power System Analysis	3	-	-	3
4	20A3202511	PEC	Professional Elective – II: Switch Gear and Protection	3	-	-	3
5	20A3204605	OEC	Open Elective –II/ Job Oriented Elective-II: Industrial Electronics	3	-	-	3
6	20A3202491	PCC	Electrical Measurements and Instrumentation Lab	-	-	3	1.5
7	20A3202492	PCC	Microprocessors and Microcontrollers Lab	-	-	3	1.5
8	20A3202493	PCC	Power Systems and Simulation Lab	-	-	3	1.5
9	20A3202991	SC	Skill Advanced Course: Machine Learning with Python Lab	_	-	-	2
10	20A3200801	MC	Research Methodology	-	-	-	0
	TOTAL CREDITS = 21.					= 21.5	
		I	Minors Course	4	0	0	4
	Honors Course			4	0	0	4

Category	Credits
Professional Core	12 5
Courses	13.5
Professional	2
Elective Courses	5
Skill advanced	
course/ Soft skill	2
course	
Open Elective	2
Courses	3
Mandatory Course	0
TOTAL CREDITS	21.5



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

NRIA20 Course Structure

IV YEAR I SEMESTER

S1. No	Course Code	Course Category	Title of the Course	L	Т	Р	Total Credits
1	20A4102511	PEC	Professional Elective – III: Renewable and Distributed Energy Technologies	3	-	-	3
2	20A4102522	PEC	Professional Elective – IV: <i>High Voltage Engineering</i>	3	-	-	3
3	20A4102531	PEC	Professional Elective – V: <i>Power System Operation and</i> <i>Control</i>	3	-	-	3
4	20A4101607	OEC	Open Elective- III /Job Oriented Elective-III: <i>Highway Engineering</i>	3	-	-	3
5	20A4103613	OEC	Open Elective-IV /Job Oriented Elective-IV: Safety Engineering	3	-	-	3
6	20A4100101	HSC	Universal Human Values-2: Understanding Harmony	3	-	-	3
7	20A4102792	MINI PROJ	Mini Project	2	-	-	2
8	20A4102791	PROJ	Industrial / Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII Semester)	-	-	_	3
9	20A4102793		Term Paper	-	-	-	1
	TOTAL CREDITS = 24						
]	Minors Course	4	0	0	4
	Honors Course			4	0	0	4

Category	Credits	
Professional Elective	0	
Courses	5	
Open Elective Courses	6	
Humanities and Social	2	
Sciences Courses	5	
Summer Internship	3	
Mini Project	2	
Term Paper	1	
TOTAL CREDITS	24	



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

NRIA20 Course Structure IV YEAR II SEMESTER

S1. No	Course Code	Course Category	Title of the Course	L	Т	P/D	Total Credi ts
1	20A4202791	Project	Major Project-Project Work, Seminar and Internship in Industry	-	-	16	8
2	20A4202792	CSP	Community Service Project	-	-	8	4
			TOI	`AL	CRI	EDIT	S = 12

Category	Credits
Major Project	08
Community Service Project	04
TOTAL CREDITS	12



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING NRIA20 Course Structure

List of Professional Elective Subjects offered to EEE Branch Students:

Professional Elective – I:

1.	Linear IC Applications
2.	Utilization of Electrical Energy
3.	Computer Architecture and Organization
4.	Optimization Techniques
5.	Object Oriented Programming through Java

Professional Elective – II:

1.	Signal and Systems
2.	Electric Drives
3.	Advanced Control Systems
4.	Switchgear and Protection
5.	Big Data Analytics

Professional Elective –III:

1.	Digital Signal Processing
2.	Renewable and Distributed Energy Technologies
3.	Flexible AC Transmission Systems
4.	Power Systems Deregulation
5.	Data Base Management Systems

Professional Elective – IV:

1.	Hybrid Electric Vehicles
2.	High Voltage Engineering
3.	Programmable Logic Controllers and Applications
4.	Cloud Computing with AWS
5.	Deep Learning Techniques

Professional Elective – V:

1.	Power System Operation and Control
2.	Switched Mode Power Conversion
3.	AI Applications to Electrical Engineering
4.	Data Science
5.	MEAN Stack Technologies



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING NRIA20 Course Structure

List of Open Electives offered by EEE Department for Other Branches:

1	Concepts of Optimization Techniques
2	Concepts of Control Systems
3	Battery Management Systems and Charging Stations
4	Fundamentals of utilization of Electrical Energy
5	Indian Electricity Act
6	Concepts of Microprocessors and Microcontrollers
7	Fundamentals of Electric Vehicles
8	Concepts of Internet of Things
9	Green Energy
10	Concepts of Power System Engineering
11	Concepts of Smart Grid Technologies



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING NRIA20 Course Structure

Courses offered for HONORS Degree for EEE Department

II B.Tech II Semester:

1.	Communication Systems
2.	Electrical Wiring, Estimation & Costing
3.	Electrical Distribution Systems

II B.Tech I Semester:

1.	Advanced Computer Networks
2.	Power Quality
3.	Special Electrical Machines

III B.Tech II Semester:

1.	Digital Control Systems
2.	Analysis of Power Electronic Converters
3.	HVDC Transmission

III B.Tech I Semester:

1.	EHV AC Transmission
2.	Smart Grid Technologies
3.	Power Electronic Control of Electrical Drives



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING NRIA20 Course Structure

<u>Courses offered for MINOR Degree by EEE Department for other</u> <u>branches</u>

II B.Tech II Semester:

1.	Fundamentals of Electrical Circuits
2.	Concepts of Electrical Measurements

III B.Tech I Semester:

1.	Analysis of Linear Systems
2.	Energy Auditing, Conservation and Management

III B.Tech II Semester:

1.	Evolutionary Algorithms
2.	Fundamentals of Power Electronics

IV B.Tech I Semester:

1.	Neural Networks and Fuzzy Logic
2.	Concepts of Electric Drives and Its Applications

20A1100101: PROFESSIONAL COMMUNICATION Common to CE,EEE,ME,ECE,CSE,IT,AIML and DS

Lectu: Credit			100	mmo		~ ~ , ~~	<u>, , , , , , , , , , , , , , , , , , , </u>	ECE,			ןפּע ו				
Credit	re – Tı	utoria	ı 1:	3-1 H	lours			Ir	nternal l	Marks:	30				
_	ts			3				E	xternal]	Marks:	70				
Prerequisites: None															
Course Objectives															
1. To 2. To pa:	 To strengthen the lexical ability of the students in different contexts. To expose the students to various sub-skills and strategies of reading and writing – summarizing and paraphrasing. To have the students develop effective exiting a bills thereach as a second paraphrasing. 														
3. To	3. To help the students develop effective writing skills through paragraph writing.														
4. 10 5 To	4. To train the students in fundamentals of grammar required to equip them with fluent English.														
vai	various literary texts.														
Cours		00000													
TT	e Out	come:	, 				C 4	1		41	. 1				
Upo	n su	cces	stul	con	nple	tion	ott	che o	course	e, the	stud	ent will be able			
to:															
CO1	Build writt	l the g en for	gramm m.	natical	struc	tures	accura	ately i	n their r	eal-time	situati	ons in either spoken or			
CO2	Exter	nd the	eir abil	lity to	use vo	ocabul	lary fr	om va	rious tex	xts along	with C	RE and technical			
	vocal	oulary	<i>i</i> n wr	itten a	and sp	ooken	comm	unica	tion						
CO3	Com speci	prehe fic for	nd, an ms of	alyze writte	and even com	valuat 1muni	e texts cation	s critio (para	cally. De graphs,	monstrat summari	e effec les, en	tive writing skills in aail and letters.)			
CO4	Apply	y the s	strateş	gies of	readi	ng var	ious t	exts a	nd grapł	ns, and d	escrib	e in prose.			
CO5	Relat	e hun	nan va	alues a	and pr	ofessi	onal e	thics	in their a	academic	, profe	ssional and social lives.			
CO6	Sum: inter	marizo pret tl	e the r hem c:	nain e ritical	vents ly.	of the	litera	ry tex	ts, from	different	socio-	cultural contexts, and			
Contr	ibutio	n o	f Co	ourse	 Out	come	s to	ward	s achi	evement	of	Program Outcomes			
(1 - L)	ow, 2-	Medi	um, 3	– Hig	;h)										
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO			
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1										1		2			
CO2										1		2			
CO3										2		2			
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CO5		1 1 1 2						-		1		2			
001	06 2						1	1		1		2 2			
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CO6 1. Te: 2. Re 3. Re Lir	xt: A D ading ading nkers,	rawer : Skin for Sign	full of nming Writin Posts	f happi text to ng: Pa and Tr	i ness f o get t aragra ransiti	from " I the ma uph W ion Sig	1 nfotec ain ide Vriting gnals;	1 h Engl a. Sca (spec Mech	I lish", Mar anning to cific top anics of	1 ruthi Publo look for ics) usin Writing -	ication specif g sui Punct	2 2 2 s ic pieces of information. table Cohesive Devices; tuation, Capital Letters.			
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4.	Vocabulary : Technical vocabulary from across technical branches (20 words). GRE Vocabulary
	Analogies (20 words) (Antonyms and Synonyms, Word applications)
5.	Grammar: Use of Articles and Zero Article; Prepositions; Connectives (25 words)
	UNIT III
1.	Text: Stephen Hawking-Positivity
•	'Benchmark' from "Infotech English", Maruthi Publications
2.	Reading : Reading a text in detail by making basic inferences - recognizing and interpreting
	specific context clues; strategies to use text clues for comprehension. Critical Reading.
3.	Reading for Writing : Summarizing - Identifying main ideas and Rephrasing what is read;
1	avoiding Redundancies and Repetitions. Letter Writing-types, Format and Principles of Letter
	Writing. E-mail Etiquette, Writing CVs.
4.	Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary
	(20 words) (Antonyms and Synonyms, Word applications) Association, Sequencing of Words
5.	Grammar: Verbs, Phrasal Verbs - Tenses; Subject-Verb Agreement;
	UNIT IV
1.	Text: Liking a Tree, Unbowed: Wangari Maathai-biography from "Infotech English", Maruthi
~	Publications
2.	Reading : Studying the use of graphic elements in texts to convey information,
	reveal trends / patterns / relationships, communicative process or display complicated data.
3.	Reading for Writing: Information transfer; describe, compare, contrast, identify
	significance/trends based on information provided in figures/charts/graphs/tables. Writing
	SOP, writing for media.
4.	Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary
	(20 words) (Antonyms and Synonyms, Word applications) Cloze Encounters.
5.	Grammar: Quantifying Expressions - Adjectives and Adverbs; Comparing and Contrasting; Use
	of Antonyms; Direct and Indirect Speech, Reporting Verbs for Academic Purposes. Idiomatic
	Expressions (25 Idioms)
UN	IT V
1.	TEXT: Stay Hungry-Stay foolish from "Infotech English", Maruthi Publications
2.	Reading : Reading for Comprehension. RAP Strategy Intensive Reading and Extensive Reading
	Techniques.
3.	Reading for Writing: Report writing (Significance, Format and Style of Writing Technical Reports)
4.	Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary
	(20 words) (Antonyms and Synonyms, Word applications) Coherence, Matching Emotions.
5.	Grammar: Change of Voice; Editing Short Texts – Identifying and Correcting Common Errors in
	grammar and usage (Articles, Prepositions, Tenses, Subject-Verb Agreement)
Te	xt Book: "Infotech English", Maruthi Publications.
RE	FERENCE BOOKS:
1.	English Grammar in Use, Raymond Murphy, Cambridge University Press.
2.	Oxford Practice Grammar, John Eastwood, Oxford University Press.
3. 4	Essential Communication Skills – Shalini Agarwal Ane Books Pyt Ltd
5.	Dictionary of Synonyms and Antonyms, Oxford & IBH, III Ed
6.	A Practical English Grammar, Agnes V. Martinet and Audrey Jean Thomson, Oxford University Press.
7.	English Vocabulary in Use, Michael McCarthy and Felicity O'Dell, Cambridge University Press
E-1	RESOURCES
1.	https://www.grammarbank.com/
2.	http://guidetogrammar.org/grammar/index.htm
ა. ⊿	https://whiteandhiliprove.com/ https://englishforeveryone.org/
· • •	
5	http://www.englishyocabulary/versises.com/
5. 6	http://www.englishvocabularyexercises.com/ https://englishplusmagazine.com/

20A1100201 ENGINEERING MATHEMATICS-I

	(Common to CE, EEE, ME, ECE, CSE, IT, AIML and DS)										
Lectu	re – Tutorial:	3-1	Internal Marks:	30							
Credit	ts:	4	External Marks:	70							
Preree	quisites: Fundai	mentals of matrices, Fundam	entals of Trigonometr	y and							
Calcu	lus.										
Cours	e Objectives:										
	• To instruc	t the concept of Matrices in solvin	g linear algebraic equatio	ns							
	• To elucidate the different numerical methods to solve nonlinear algebraic equations										
	• To dissem	inate the use of different nume	erical techniques for								
	carrying o	ut numerical integration.									
	• To equip	the students with standard	concepts and tools a	t an							
	intermedia	ate to advanced level mathematics	to develop the confidence	e and							
	ability am	ong the students to handle vari	lous real world problems	and							
Cours	e Outcomes:										
CO1	Student will be	able to develop the use of mat	rix algebra techniques t	hat is							
001	needed by engin	peers for practical applications	(L6)								
	solve system of	linear algebraic equations usin	Gauss elimination G	21155							
	Seidel and writ	e Eigen values and eigenvector	rs of a matrix (L_3)	lauss							
CO2	Student will be	able to write diagonal form an	d different factorization	s of a matrix							
	(L3), to find inve	erse of a matrix and integral po	owers of a matrix by Ca	vlev-							
	Hamilton Theor	rem		99							
	identify the na	ture of a Quadratic form such	as positive definite, pos	itive semi							
	definite etc., an	d use this information to facilit	tate the calculation of n	natrix							
	characteristics	(L2)									
CO3	Student will be	able to evaluate the approxim	ate roots of polynomial	and							
	transcendental	equations by different algorith	ms (L5)								
CO4	Student will be	able to apply Newton's forward	d & backward interpola	tion							
	and Lagrange's	formulae for unequal interval	s (L3)								
CO5	Student will be	able to apply numerical integr	al techniques to differe	nt							
	Engineering pro	oblems (L3)									
CO6	Student will be	able to apply different algorith	ms for approximating t	he							
	solutions of ord	inary differential equations wit	in initial conditions to i	ts							
	anaiyucai comp	outauons (LS)									

Contribution of Course Outcomes towards achievement of Program Outcomes (1 -Low, 2- Medium, 3 – High)

	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	2	2								
CO2	3	3	2	2								
CO3	3	3	2	2								
CO4	3	3	2	2								
CO5	3	3	2	2								
CO6	3	3	2	2								

UNIT - I: Solving systems of linear equations, Eigen values and Eigen vectors: (10hrs)

Rank of a matrix by echelon form and normal form - Solving system of homogeneous and non- homogeneous linear equations - Gauss

Elimination method – Eigen values and Eigen vectors and properties.
Unit – II: Cayley–Hamilton theorem and Quadratic forms:
(10hrs)
Cayley-Hamilton theorem (without proof) – Applications – Finding the
inverse and power of a matrix by Cayley-Hamilton theorem – Reduction
to Diagonal form – Quadratic forms and nature of the quadratic forms –
Reduction of quadratic form to canonical forms by orthogonal
transformation.
UNIT – III: Iterative methods:
(8 hrs)
Introduction– Bisection method – Method of false position– Iteration
method
Newton-Raphson method (One variable).
Gauss-Jacobi and Gauss-Seidel methods for solving system of equations
numerically.
UNIT – IV: Interpolation: (10 hrs)
Introduction- Errors in polynomial interpolation - Finite differences-
Forward differences– Backward differences –Central differences –
Relations between operators – Newton's forward and backward
formulae for interpolation – Interpolation with unequal intervals –
Lagrange's interpolation formula.
UNIT -V: Numerical integration and Solution of ordinary differential
equations with initialconditions
(10 hrs)
Trapezoidal rule- Simpson's $1/3^{rd}$ and $3/8^{th}$ rule- Solution of initial
value problems by Taylor's series– Picard's method of successive
approximations– Euler's method –Modified Euler's method – Runge-
Kutta method (second and fourth order).
TEXT BOOKS:
 B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
3. David Poole, Linear Algebra- A modern introduction, 4 th Edition, Cengage.
REFERENCE BOOKS:
1. Steven C. Chapra, Applied Numerical Methods with MATLAB for
Engineering and Science, Tata Mc. Graw Hill Education.
2. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for
Scientific and Engineering Computation, New Age International
3. Lawrence Turvn. Advanced Engineering Mathematics CRC Press
E-RESOURCES:1. www.nptel videos.com/mathematics/(Math Lectures from
MIT,Stanford,IIT'S
2. nptl.ac.in/courses/1221104017

20A1100203 : APPLIED PHYSICS (Common to EEE and ECE)

				(Co	ommo	n to E	EE and	I ECE)				
Lectu	<u>ire – Ti</u>	utorial	l: 3-	0]	nterna	al Mar	ks:	30
Credi	ts:		3					I	Extern	al Mar	ks:	70
Prere magn	quisite etism	es: Kno	owledg	e on f	undam	iental	conce	pts of [,]	waves,	optic	s, sou	nd and
Cours	se Obje	ectives	:									
 Th Ph 	e cours ysics in	se aims a broa	s at ma der sen	aking s se with	tudents a view	s to un to lay f	iderstar foundat	nd the ion for t	basic o the vari	concept ous eng	s of Pr gineerir	rinciples of ng courses.
✤ To	develop	o analyt	tical cap	pability	and so	lve vari	ous eng	gineerin	g proble	ems.		
Cours	se Out	comes	:		<u>c 1: 1 ;</u>	• . 1		. 1	1 .			
COI	Apply	the i	interac	tion o	i light	with	matte	r throu	igh in	teriere:	nce, d	liffraction,
	polari	ization	instrut	nents	these	pnenoi	mena n	n amei	епт па	lurai c	ptical	processes
CO2	Annly	$\frac{1}{2}$ the c	omprei	nended	know	ledge a	about 1	aser at	nd fibr	e ontic	comm	unication
002	syster	ms in v	various	engin	eering	applica	ations.	uber ui	iu iibi	e optie	comm	iumeanon
CO3	Inter	oret th	e know	vledge	of diele	ectric a	and ma	gnetic	mater	ials wi	th cha	racteristic
	utility	y in ap	pliance	es.				C				
CO4	Apply	the k	nowled	lge of	basic o	quantu	am me	chanic	s, to se	et up o	one di	mensional
	Schro	odinger	's wave	e equa	tion an	ld its a	pplicat	ion to	a infini	te pote	ential v	vell.
CO5	Sumr	narize	the in	nporta	nce of	free e	lectron	is in d	etermi	ning ti	he pro	perties of
	metal	is and	under	rstand	the of	rigin ð	s role	of ene	rgy ba	nds in	class	ilying the
C06	Unde	s retand	the n	hysics	of Set	micond	luctors	and t	heir w	orking	mech	anism for
000	their	utility	in sens	sors.	01 001		luctors	and t	iicii w	orming	meen	
		j										
Cont	ributio	n of C	ourse	Outco	mes to	owards	achie	vemen	t of Pr	ogram	Outc	omes (1 –
Low,	2- Med	lium, S	3 – Hig	gh)						-		·
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3				3					3		
CO2	3	3		2	2					3		
CO3	3	3			2							
CO4	3											
CO5	3		2		2							
CO6	3				2							
Unit-	I: Wav	e Opti	cs									
(12hr	(S) former of	o Duin		f		un Tunt	~ <i>m</i> f ~ <i>m</i> ~ <i>m</i>	as of li	∼lat Ta	at a mf a m		+10.00
Cil		e: Prin	cipie o	i super		n –int	erieren		gnt - Ir	nteriere	ence ir	
nims	(Reffec	tion Ge	eometr	y) - Co	lors in	thin II	ims- in	ewtons	s Rings	- Dete	rminat	101 01
wavel	length a	and rei	ractive	e index	•	1 5	1 0	1.00	,· ,	D 1	C 1	· cc / ·
Dillra	action:	Introc	luction	- Fres	nel an	d Frau	nnoier	dillrac	tion - 1	Fraunr		illraction
due te	o single	e slit, d	louble	slit - N	-slits (Qualita	ative) –	Diffra	ction G	rating	- Disp	ersive
power	r and r	esolvin	ig powe	er of Gi	rating	Qualit	ative).					
Polar	izatior	1: Intro	oductio	n-Type	es of po	olarizat	10n - L	ouble	refract	10n - N	1col's l	Prism -
Half v	wave ar	nd Qua	rter wa	ave pla	ites.							
Unit-	II: Las	ers an	d Fibe	r opti	cs							
(8hrs	.)											
Laser	s: Intro	oductio	on – Ch	naracte	eristics	of lase	er – Spo	ontane	ous an	d Stim	ulated	
emiss	sions of	radiat	tion – E	Einstein	n's coe	fficient	ts – Pop	oulation	n inver	sion –	Lasing	gaction -
Pumr	oing Sci	hemes	- Ruby	v laser	– He-N	le lase	r - App	lication	ıs of la	sers.		
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Aperture -

Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers - Applications.

Unit-III: Magnetic and Dielectric Materials

(10hrs)

Magnetic Materials: Introduction - Origin of permanent magnetic moment - Classification of

magnetic materials: Dia, para, Ferro, antiferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility and Dielectric constant - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field- Clausius- Mossotti equation.

Unit IV: Quantum Mechanics, Free Electron Theory (8hrs)

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory– Equation for electrical conductivity based on quantum free electron theory- Fermi-Dirac distribution- Fermi energy-Density of states.

Unit – V: Band theory of Solids &Semiconductors (10hrs)

Band theory of Solids: Bloch's Theorem (Qualitative) - Kronig - Penney model (Qualitative)- E vs K diagram - v vs K diagram - effective mass of electron – Classification of crystalline solids-Concept of hole.

Semiconductors: Introduction- Intrinsic semiconductors – Density of charge carriers – Electrical conductivity – Fermi level – extrinsic semiconductors – density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation- Hall effect – Hall coefficient –Applications of Hall effect.

TEXT BOOKS:

- 1. **M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy**" A Text book of Engineering Physics"- S.Chand Publications, 11th Edition 2019.
- 2. Engineering Physics by **P.K.Palanisamy** SciTech publications

REFERENCE BOOKS:

- 1. Engineering Physics by **M.R.Srinivasan**, New Age international publishers (2009).
- 2. Engineering Physics Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press
- 3. **B.K. Pandey and S. Chaturvedi**, Engineering Physics, Cengage Learning

E-RESOURCES: <u>www.doitpoms.ac.uk</u>,

http://www.itp.uni-hannover.de/~zawischa/ITP/diffraction.html, http://www.coherent.com/products/?834/Lasers, http://plato.stanford.edu/entries/qm/

20A1103301: ENGINEERING GRAPHICS

(Common to EEE and ECE)

Lectu	ıre – F	Practic :	al:	2 -	2 Hour	:s			In	ternal M	larks:	30
Credi	its:			3					Ex	ternal M	Iarks:	70
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Cours	se Obj	ectives	5:									
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	poly	gons, E	ngg. C	urves	and sca	ales.						
2.	. To ir	ntroduc	e the	stude	ents to	use or	thogra	phic p	rojectio	ns, proje	ection of	
	poin	ts & sir	nple li	nes.								
3.	. To m	lake the	e stud	ents d	raw the	e projec ⁻	tions c	of the li	nes inc	lined to	both the	
	plan	es.										
4.	To m	lake the	e stud	ents d	raw the	e project	tions o	f the pl	lane inc	clined to	both the)
	plan	es.										
5.	. To m	iake th	e stud	ents d	raw the	e projec	tions c	of the v	arious	types of	solids in	
	diffe	rent po	sitions	inclin	ied to of	ne of the	e plane	es.				
6.	To re	present	the obj	ect in 3	3D view	through	isomet	ric view	s and to	convert t	he isomet	tric
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will	bea	able 1	to:									
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005	and i	nclined	l to bot	th the	planes.	,						
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006	and v	vice ver	sa.									
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CO_2	<u>১</u> 3	2	-	-	-	-	-	-	-	<u>১</u> ২	-	1
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CO5	3	2	-	-	2	_	_	_	_	3	_	1
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						UNIT	I					
Polvg	zons: (Constru	acting	regula	r polyge	ons by g	eneral	metho	ds, insc	ribing ar	ıd	

describing polygons on circles.

Curves: Parabola, Ellipse and Hyperbola by general and special methods, tangents

& normals for the curves.

Scales: Plain scales, diagonal scales and vernier scales

UNIT II

Orthographic Projections: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination.

UNIT III

Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

UNIT IV

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to both the planes.

UNIT V

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer Aided Design, Drawing practice using Auto CAD, Creating 2D&3D drawings of objects using Auto CAD

Note: In the End Examination there will be no question from CAD.

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications

2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers **REFERENCE BOOKS:**

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers

2. Engineering Graphics for Degree by K.C. John, PHI Publishers

3. Engineering Graphics by PI Varghese, McGrawHill Publishers

4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

20A1105301:-Programming and Problem solving with C (Common to EEE,ME,ECE,CSE,IT,AIML and DS)

Lecture Practic	e – Tuto al::	orial-	3-0-0					I	nterna	l Marks	:	30
Credits	5:		3					E	xterna	1 Marks	s:	70
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DECISION STATEMENTS: The if statement, if-else, nested if else, if-else-if ladder, break, continue goto, Switch statement, nested switch case, Switch case and nested ifs.

LOOP CONTROL: for loop, nested for loop, while, do-while, do-while statement with while loop.

ARRAYS: Array initialization, array terminology, characteristics of an array, 1-D array and its operations, 2-D arrays and operations, Multi -dimensional arrays.

STRINGS: Declaration and initialization of string, string standard functions, string conversion functions, memory functions, application of strings.

UNIT III: Objective: Modular programming and recursive solution formulation and storage classes

FUNCTIONS: Basics, function definition, return statement, types of functions, call by value ,call by reference, function as an argument, Functions with operators, Function and Decision Statements, Functions and loop Statements, Functions with arrays and Pointers Recursion-Types of Recursion, Rules for Recursive Function, Recursion versus Iterations Advantages and Disadvantages of Recursion, Efficiency of Recursion, Library Functions. STORAGE CLASS: Variable Lifetime, Automatic Variables, External Variables, Static Variables, Register Variables.

UNIT IV: Objective: Understanding pointers, dynamic memory allocation and Preprocesson Directives.

POINTERS: Features of pointers, pointers and address, pointer declaration, void pointers arithmetic operations with pointers, pointers and arrays, array of pointers, pointers to pointers, pointers and strings. Dynamic memory allocation

PREPROCESSOR DIRECTIVES: The #define Directive, Defining and Undefining a Macros The #include Directive

UNIT V: Objective: Understanding derived data types of C and basic of file operations.

STRUCTURE AND UNION: Features of Structures, Declaration and initialization of Structures, Structure within Structure, Arrays of Structure, Pointer to Structure Structure and functions, typedef, Bit fields, Enumerated Data Type, Unions and Unions Vs Structures.

FILES: Streams and File Types, Steps for File Operations, FILE I/O, Structures Read and Write, Other file function, Command line Arguments.

TEXT BOOKS:

[1] Behrouz A. Forouzan & Richard F. Gilberg, —"Computer Science A Structured Programming Approach using C", CENGAGE Learning, Third Edition.

REFERENCE BOOKS:

[1]Kernighan and Ritchie, —"The C programming language", The (Ansi C Version), PHI second edition.

[2]Yashwant Kanetkar, -"Let us C", BPB Publications, 2nd Edition 2001.

[3]Paul J. Dietel and Dr. Harvey M. Deitel, -"C: How to Program", Prentice Hall, 7 th edition (March 4,2012).

[4]Herbert Schildt, –"C:The Complete reference", McGraw Hill, 4th Edition, 2002.

[5]K.R.Venugopal, Sundeep R Prasad, —"Mastering C", McGraw Hill, 2nd Edition, 2015 **E-RESOURCES:**

1.http://cslibrary.stanford.edu/101/EssentialC.pdf

2. http://nptel.ac.in/courses/106104128/

3.http://www.vssut.ac.in/lecture_notes

20A1100292 : APPLIED PHYSICS LAB (Common to EEE AND ME)

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Labs / Hours	/ Instr s/Weel	uction c	IS 3					I	nterna	al Marl	s:	30
Credi	ts:		2					E	Extern	al Mar	ks: 7	70
Prere	quisite	es: Kno	owledg	e on v	ernier	callip	ers, Sc	rew gu	iage, c	ommo	n bala	nce
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	relate	with th	e theore	etical st	udies.							
*	To ach	ieve pe	rfectnes	ss in ex	perimei	ntal ski	lls and	the stu	dy of pr	actical	applicat	tions will
	bring i	nore co	nfidenc	e and a	ability to	o develo	op and i	labricat	e engin	eering a	and tech	inical
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Cours	se Out	comes	:		uracy o	mouse	11 01110111					
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	result	s with	theore	tical ca	alculat	ions.	0				1	
CO2	Analy	ze the	physic	al prin	ciple in	nvolved	l in the	variou	ıs insti	rument	s; also	relate
	the p	rinciple	e to nev	w appli	ication	•						
CO3	Unde	rstand	design	of an	instru	ment w	vith tar	geted a	accura	cy for p	hysica	1
	meas	uremei	nts.					-			-	
CO4	Devel	op skil	ls to in	npart p	oractica	al knov	vledge	in real	time s	olution		
CO5	The v	arious	experi	ments	in the	areas o	of optic	s, mec	hanics	and th	nermal	physics
	will n	urture	the stu	udents	in all	branch	les of E	Inginee	ering			
CO6	Think	innov	atively	and al	so imp	prove th	ne crea	tive sk	ills tha	it are e	ssentia	l for
	engin	eering.										
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CO2	3	3		3					3			
CO3	3	3	1	3					3			
CO4	3	3		3								
CO5	3											
CO6	3	3	2	3								

List of Experiments

- 1. Study of variation of magnetic field along the axis of a current carrying circular coil by Stewart & Gee's method.
- 2. Determination of numerical aperture and acceptance angle of an optical fiber.
- 3. Determination of thickness of thin object by wedge method.
- 4. Determination of radius of curvature of given plano convex lens by Newton's rings.
- 5. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
- 6. Determination of dispersive power of the prism.
- 7. Sonometer: Verification of laws of string.
- 8. Study of I/V Characteristics of Semiconductor diode.
- 9. I/V characteristics of Zener diode.
- 10. Melde's experiment-Longitudinal and Transverse mode.
- 11. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).

- 12. Estimation of Planck's constant using photoelectric effect.
- 13. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect
- 14. Determination of wavelength of Laser light using diffraction grating.

15. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum).

Note: Any 8 experiments out of 15 should be done in the laboratory and 2 experiments in virtual lab.

TEXT BOOKS:

S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

REFERENCE BOOKS:

Engineering Physics / Applied Physics Lab Manual – Spectrum Publications

E-RESOURCES: <u>www.vlab.co.in</u>

20A1105391-Programming and Problem Solving with C Lab (Common to EEE,ME,ECE,CSE,IT,AIML and DS)

			minon	LUEE	C, IVI C, C	LCE,CO	с,11,AI		<u>u Doj</u>			
Lectur	e – Tu	torial-	0-0-4	1				Iı	iternal	Marks	:	30
Practi	cal::										•	
Credit	s:		2					E	xterna	l Marks	5:	70
Prereg	uisites	5:										
Course	e Objec	tives:										
1. To n	nake th	le stude	ent lear	m a pro	ogramn	ning lar	nguage.					
2. To 1	earn pr	oblem	solving	techni	ques.							
3. To t	each th	le stude	ent to w	vrite pr	ograms	s in C a	nd to so	olve the	e proble	ms		
Course	e Outco	omes:										
Upor	n suo	ccess	sful d	com	oletic	on of	the	cou	rse. 1	the s	tude	nt
will	be at	ole to	D:						,			
CO1	Under	rstand	hasic S	Structu	ire of t	he C-P	ROGRA	MMINC	t decla	ration	and us	age
001	of var	iables	Subic .	Judete			nouru		, accie	auton	una uo	uge
CO2	Exerc	ise con	ditiona	1 and i	terative	statem	ents to	inscrib	e C pro	orams		
CO3	Exerc	ise use	r define	n ana i A func	tions to	n solve	real tim	nioerni ne prohi	lems	Siamo		
CO4	Inscri	he C n	rogram	s iising	p Pointe	ers to a	rcess ar	ravs s	trings a	nd fim	ctions	
CO5	Inscri	he C	nrogran	ns 115	ing noi	inters	and all	ocate	memor	v iising	y dyna	mic
000	memo	orv mar	nageme	nt fund	ctions		and an	ocute		, 40112	s ayına	
CO6	Exerc	ise use	er defir	ned da	ta type	es inclu	iding s	tructur	res and	lunion	s to so	olve
000	proble	ems		2002 000	Jac of pe				00 0010			521.0
CO7	Exerc	ise files	s conce	pt to s	how inr	out and	output	of files	in C			
Contri	bution	of Co	urse Oi	itcom	es towa	rds ac	hievem	ent of	Progra	m Outo	comes	(1 -
Low, 2	2- Medi	um. 3	– High))					8			· –
	PO	PÓ	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	1		3									
CO2			2									
CO3			3									
CO4			2									
CO5			3									
CO6		2	3									
CO7		1	3									
Exerci	se 1:											
1 117.1				• , 1	1 1 5	1	1. (11)	1	(1 D	1 1	• • •	c

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.

2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.

3. Write a C program to display multiple variables.

Exercise 2:

1. Write a C program to calculate the distance between the two points.

2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3:

1. Write a C program to convert a string to a long integer.

2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.

3. Write a C program to calculate the factorial of a given number Exercise 4:

1. Write a program in C to display the n terms of even natural number and their sum.

2. Write a program in C to display the n terms of harmonic series and their sum. 1 +

 $1/2 + 1/3 + 1/4 + 1/5 \dots 1/n$ terms. 3. Write a C program to check whether a given number is an Armstrong number or not. Exercise 5: 1. Write a program in C to print all unique elements in an array. 2. Write a program in C to separate odd and even integers in separate arrays. 3. Write a program in C to sort elements of array in ascending order. Exercise 6: 1. Write a program in C for multiplication of two square Matrices. 2. Write a program in C to find transpose of a given matrix. Exercise 7: 1. Write a program in C to search an element in a row wise and column wise sorted matrix. 2. Write a program in C to print individual characters of string in reverse order. Exercise 8: 1. Write a program in C to compare two strings without using string library functions. 2. Write a program in C to copy one string to another string. Exercise 9: 1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation 2. Write a program in C to demonstrate how to handle the pointers in the program. Exercise 10: 1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator. 2. Write a program in C to add two numbers using pointers. Exercise 11: 1. Write a program in C to add numbers using call by reference. 2. Write a program in C to find the largest element using Dynamic Memory Allocation. Exercise 12: 1. Write a program in C to swap elements using call by reference. 2. Write a program in C to count the number of vowels and consonants in a string using a pointer. Exercise 13: 1. Write a program in C to show how a function returning pointer. 2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc() function. Exercise 14: 1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc() function. Understand the difference between the above two programs 2. Write a program in C to convert decimal number to binary number using the function. Exercise 15: 1. Write a program in C to check whether a number is a prime number or not using the function. 2. Write a program in C to get the largest element of an array using the function. Exercise 16: 1. Write a program in C to append multiple lines at the end of a text file. 2. Write a program in C to copy a file in another name. 3. Write a program in C to remove a file from the disk. **TEXT BOOKS:** [1] Behrouz A. Forouzan & Richard F. Gilberg, -"Computer Science A Structured Programming Approach using C", CENGAGE Learning, Third Edition. **REFERENCE BOOKS:** [1]Kernighan and Ritchie, -"The C programming language", The (Ansi C Version), PHI, second edition.

[2]Yashwant Kanetkar, —"Let us C", BPB Publications, 2nd Edition 2001.
[3]Paul J. Dietel and Dr. Harvey M. Deitel, —"C: How to Program", Prentice Hall, 7 th edition (March 4,2012).

[4]Herbert Schildt, —"C:The Complete reference", McGraw Hill, 4th Edition, 2002.
[5]K.R.Venugopal, Sundeep R Prasad, —"Mastering C", McGraw Hill, 2nd Edition, 2015

E-RESOURCES:

1.http://cslibrary.stanford.edu/101/EssentialC.pdf

2. http://nptel.ac.in/courses/106104128/

3.http://www.vssut.ac.in/lecture_notes

20A1200201 : ENGINEERING MATHEMATICS-II (Common to All Branches)

Loct	1 * 0 T	utoria	1. 2	1	Junit		ш Бга		ntore	1 Mar1		30
Lectu	ter – 1	uloria	1; J- 1	1					nuerna Net o m		1.0	70
Creat			4		- C 4		D		Lxtern	ai mar	KS:	10
Prere Calcu	quisite lus.	es: Fui	ndame	entals (of mat	rices,	Funda	imenta	als of .	rigon	ometr	y and
Cours	se Obje	ectives	s:									
	• T d	o fami evelopii	liarize ng intu	a vari ition ab	ety of out the	well-ki behavi	nown our of 1	sequen new one	ces an es.	d serie	es, wit	n a
	• T ca	o enligi alculus	nten th	e learne	ers in t	he conc	cept of	differen	tial equ	lations	and m	ultivariable
	• T a	o equip dvance tudents	the st d level to han	udents mather dle vari	with st natics ious rea	andard to deve al world	l conce lop the l proble	pts and confid ms and	l tools a ence a l their a	at an ir nd abili applicat	ntermed ty amo ions.	liate to ng the
Cours	se Out	comes	5:				•					
CO1	Stude first o know probl	ent will legree the ap ems ar ent will	l be ab ordina oplicat: nd find l be ab	le to fi ry diffe ions of <u>l ortho</u> le to id	nd the crentia Newto gonal t lentify	Gener l equat n's law rajecto the es	al/Par tions b of coo ories of sentia	ticular y appl y oling, n <u>f the gi</u> l chara	soluti y diffen atural ven far octerist	ons of rent me growth nily of rics of l	first or ethods n and o curves inear	der and (L3), lecay . (L3)
002	differ	ential o tions w	equation	ons wit nstant	h cons coeffic	stant co ients b	pefficie v appi	ents. (L ropriate	2)solv e meth	e the li od (L3)	near d	ifferential
CO3	Stude	ent will	l be ab	le to fi	nd con	vergen	$\frac{ce}{ce}$ (or)	diverg	ence o	f a seri	es (L3)	
CO4	Stude	ent will	l be ab	le to u	tilize n	iean va	alue th	eorem	s to rea	al life p	roblen	ns (L3)
CO5	Stude	ent will	l be ab	le to fi	nd par	tial der	rivative	es num	ericall	v and s	symbol	ically and
	use t	hem to	analv	ze and	l interr	oret the	e wav a	a funct	ion vai	ries. (L	4)acou	ire the
	Know	vledge 1	maxim	a and	minim	a of fur	nctions	s of sev	reral va	riable	(L1)Ut	ilize
	Jacol	bian of	a coor	dinate	transf	ormati	on to o	leal wi	th the	proble	ms in c	change of
	varia	bles (L	3)							F		8
CO6	Stude	ent will	l be ab	le to fi	nd len	gth of t	the ar	c. volu	me of s	solid of	revolu	tion and
	surfa	ce area	a of sol	id of re	evoluti	on (L3)		-,				
Conti – Low	ributio 7, 2- M	on of C edium	c ourse 1, 3 – I	Outco Iigh)	mes t	owards	s achio	eveme	nt of F	rograr	n Outo	comes (1
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	2	2								
CO2	3	3	2	2				ļ				
<u>CO3</u>	3	3	2	2								
<u>CO4</u>	3	3	2	2								
<u>CO5</u>	3	3	2	2								
CO6	3	3	2	2								
U (1 Li ec	NIT I Ohrs) inear quation f natur	- I: differen ns redu val grov	Diffe ntial e ucible wth an	rential equatio to exac d deca	equ ns– B t form y– Orth	ations ernoul Appli nogona	of li's ec cation l traje	first Juation s: New ctories	order s –Ex ton's I	and act equaw of	first uation cooling	degree s s and g– Law
(10hr	UNIT- s)	II:	Linea	r I	Differe	ntial	eqı	ations	§ 0	f h	igher	order

TT 1 NT 1 1:00	1	, •	C 1 · 1	1
Homogeneous and Non-homogeneous diffe	erential	equation	s of high	er order
with constant coefficients – with non-nomog	geneous (ie type e	x, sin ax,
$\cos ax$, polynomials in x^n , $e^{ax}V(x)$ and	$X^{II}V(X) -$	Method	l oi vari	ation of
parameters, Cauchy and Legendre's linear e	quations	3. 		
UNIT – III: Sequences, Series	and	Mean	value	theorems:
(10nrs)				•
Sequences and Series: Convergences and di	vergence	– Ratio	test – Cor	nparison
tests – Integral test – Cauchy's root test – Al	ternate s	series– Le	ibnitz's r	ule.
Mean Value Theorems (without proofs): R	olle's Th	eorem –	Lagrange	e's mean
value theorem – Cauchy's mean value th	eorem –	Taylor's	and Ma	claurin's
theorems with remainders, Problems and ap	plication	is on the	above th	eorem.
UNIT - IV:	Parti	al	diff	erentiation:
(10nrs)			-1 -1	·
Introduction – Homogeneous function – Eul	er's theo:	rem- 10t	al derivat	ive-
Chain rule– Jacobian – Functional depender	nce – lay	lor's and	MacLaur	111´S
series expansion of functions of two variable	es.Applic	ations: M	axima ar	1 C
Minima of functions of two variables withou	t constra	unts and	Lagrange	è'S
multiplied method.				
UNIT – V: Multiple integrals:				(0)
(8nrs)				(8
nrsj			1	
Double and Imple integrals – Change of ord	er of inte	gration i		1:
Integrals – Change of variables to polar, cyli	narical a	na spner	ical coord	inates.
Applications: Finding Areas and Volumes				
TEXT BOOKS:		D 11.1	7.71	D 1 1 1
I. B. S. Grewal , Higher Engineering Mathema	$t_{1}c_{1}c_{2}c_{3}c_{4}c_{1}c_{3}c_{4}c_{1}c_{2}c_{3}c_{4}c_{1}c_{3}c_{4}c_{1}c_{3}c_{4}c_{1}c_{3}c_{4}c_{1}c_{3}c_{4}c_{1}c_{3}c_{4}c_{1}c_{3}c_{4}c_{1}c_{3}c_{4}c_{1}c_{3}c_{4}c_{1}c_{5}c_{4}c_{4}c_{1}c_{5}c_{4}c_{4}c_{1}c_{5}c_{4}c_{4}c_{1}c_{5}c_{4}c_{5}c_{4}c_{5}c_{5}c_{5}c_{5}c_{5}c_{5}c_{5}c_{5$	Edition,	Khanna	Publishers.
2. B. V. Ramana, Higher Engineering Mathema	atics, 200)7 Editio:	n, Tata M	c. Graw Hill
Education.				
KEFEKENCE BOOKS:		101 -	1	1 +
1. Erwin Kreyszig, Advanced Engineering Mat	thematic	s, 10 th Eo	lition, Wi	ley-India.
2. Joel Hass, Christopher Heil and Maurice I	J. Weir,	Thomas	calculus,	14 th Edition,
Pearson.	.1 .•			0
3. Lawrence Turyn, Advanced Engineering Ma	thematic	s, CRC F	ress, 201	3.
4. Srimantha Pal, S C Bhunia, Engineering Ma	thematic	es, Oxford	1 Univers	ity Press.
E-RESOURCES:	- .	<u> </u>		
L. www.nptel.videos.com/mathematics/(Math	l Lecture	es from]	MIT.Stan	tord.IIT'S

2. nptl.ac.in/courses/1221104017

20A1200205: APPLIED CHEMISTRY (Common to EEE and ECE)

Lectu	re – Tu	itorial	: 3-	1				Í	nterna	l Mark	s: 3	80
Credi	ts:		4					E	xterna	1 Mark	ks: 7	'0
Prere	quisite	s:										
Cours	se Obje	ctives	:									
•	Impor	tance o	of usag	e of pla	astics i	n hous	sehold	appliar	nces ar	id com	posites	s (FRP) in
	aerosp	pace ar	nd auto	motive	e indus	tries.						
•	Outlin	ie the	basics	for th	e cons	structio	on of e	electroc	hemica	al cells	, batte	eries and
	fuel ce	ells. Ur	idersta	nd the	mecha	anism (of corro	osion a	nd hov	<i>i</i> t can	be pro	evented.
•	Explai	in the	prepa	ration	of se	micono	ductors	s and	nanon	nateria	ls, en	gineering
	applic	ations	of nan	omate	rials, si	uperco	nducto	ors and	liquid	crystal	s.	c
•	Recall	the in	crease	in den	nand to	or pow	er and	hence	alterna	ative so	ources	of power
	are st	udied	due te	o depl	eting s	sources	s of to	ssil fu	els. Ad	lvance	d inst	rumental
	techni	ques a		basies	l.		tion of	a 1a a ma i	atura a		1	
•	switch	Ouuin	le the	Dasics	6 01 CO	mputa	uionai	cheim	stry a	10 1110	lecular	
Cours	switch	comes	•									
CO1	Analy	ze the	, differe	nt type	es of co	mposi	te nlas	tic mat	erials	and		
001	inter	bret th	e mech	anism	of con	iductio	n in co	nducti	ng poly	mers.		
CO2	Predic	t poter	ntial co	mplica	ations f	rom co	mbini	ng vari	ous Ch	emical	s, meta	als in
	engin	eering	setting	and ca	ategori	ze mat	erials s	science	releva	nt to co	orrosio	n
	pheno	omena.	C		U							
CO3	Apply	new n	naterial	ls with	excelle	ent eng	gineerir	ng prop	erties	take	care	
	of soc	iety ne	eds an	d envii	conmer	nt.						
CO4	Analy	ze the	princip	oles of o	differer	nt anal	ytical i	nstrun	nentatio	on and		
	applic	cations										
CO5	Desig	n mode	els for e	energy	by diff	erent r	natural	source	es			
CO6	Under	rstand	the kn	owledg	ge of co	mputa	tional	chemis	try and	l molec	cular	
<u> </u>	mach	ines		<u> </u>							<u> </u>	
Conti	1butio 2- Med	n of Co	Durse (Jutcor	nes to	wards	achiev	ement	t of Pro	ogram	Outco	mes (1 –
LOW,				II) DO	PO	DO	DO	PO	DO	DO	DO	DO
	1	2	3	4	5	6	7	8	9	10	11	12
	-		0		0	•	-			10		14
CO1	3	3	3	2	-	-	2	-	-	-	-	-
CO2	3	3	2	1	-	-	2	-	-	-	-	-
CO3	3	2	2	-	-	-	2	-	-	-	-	-
CO4	3	3	2	2	-	-	2	-	-	-	-	-
CO5	3	2	2	2	-	-	2	-	-	-	-	_
CO6	3	3	3	3	-	-	3	-	-	-	-	-

UNIT – I: POLYMER TECHNOLOGY

Polymerisation:- Introduction, methods of polymerization (emulsion and suspension), mechanical properties.

Plastics:Thermoplastic-Thermosetting, Compounding, fabrication (compression, injection, Transfer and extrusion), preparation, properties and applications (PVC, polycarbonates and Bakelite), mention some examples of plastic materials used in electronic gadgets.

Elastomers:- Introduction, preparation, properties and applications (Buna S, thiokol and polyurethanes).

Composite materials: Fibre reinforced plastics, conducting polymers, biodegradable polymers..

Unit – II: ELECTROCHEMICAL CELLS AND CORROSION
Single electrode potential, electrochemical series and uses of series, standard
hydrogen electrode, calomel electrode, batteries (Dry cell, liquid Li ion battery), fuel
cells (H2-O2).
Corrosion:-Definition, theories of corrosion (chemical and electrochemical), galvanic
corrosion, differential aeration corrosion, factors influencing rate of corrosion,
corrosion control method- Protective coatings (Galvanizing tinning electronlating and
electroless plating [nickel])
INIT _ III. MATEDIAL CHEMISTRY
Semiconductors: Preparation of semi conductors by zone refining Czochralski
oristal pulling applications
Super conductors Type I Type II and emplications
None metericles. Type II and applications
Nano materials:- Introduction, sol-gel method & Chemical reduction method of
preparation, transmission electron microscopy [IEM], applications of fullerenes,
carbon nanotubes (types, preparation and applications)
Liquid crystals:- Introduction-types-applications.
UNIT - IV :SPECTROSCOPIC TECHNIQUES & NON-CONVENTIONAL ENERGY
SOURCES
SPECTROSCOPIC TECHNIQUES: Electromagnetic spectrum-UV laws of ab:sorption,
instrumentation, theory of electronic spectroscopy, Frank-condon principle,
chromophores and auxochromes, applications, FT-IR Basic principle, instrumentation
and IR stretching of functional groups (alcohols, carbonyls, amines) applications,
NON-CONVENTIONAL ENERGY SOURCES Design, working, schematic diagram,
advantages and disadvantages of photovoltaic cell, hydropower, geothermal power,
tidal and wave power, ocean thermal energy conversion.
UNIT -V: ADVANCED CONCEPTS/TOPICS IN CHEMISTRY
Computational chemistry: Introduction to computational chemistry molecular
modelling and docking studies
Molecular switches: characteristics of molecular motors and machines
Rotavanes and Catenanes as artificial molecular machines, prototypes
linear motions in rotovanes an acid hase controlled molecular
abuttle a malagular alguatar, an autonomous light neward malagular
silutile, a molecular elevator, an autonomous light-powered molecular
TEXT BOOKS:
1. P.C. Jain and M. Jain "Engineering Chemistry", 15/e, Dhanpat Rai &
Sons, Delhi, (Latest edition).
2. Shikha Agarwal, " Engineering Chemistry ", Cambridge University Press, New
Delhi, (2019).
3. S.S. Dara, "A Textbook of Engineering Chemistry", S.Chand & Co, (2010).
4. Shashi Chawla, "Engineering Chemistry", Dhanpat Rai Publicating Co.
(Latest edition).
REFERENCE BOOKS:
1. K. Sesha Maheshwaramma and Mridula Chugh, "Engineering Chemistry",
Pearson India Edn.
2. (a) O.G. Palana, "Engineering Chemistry". Tata McGraw Hill Education
Private Limited, (2009).
(b) CNR Rao and JM Honig (Eds) " Preparation and characterization of
materials" Academic press, New York (latest edition)
3. B. S. Murthy, P. Shankar and others. "Textbook of Nanoscience and
Nanotechnology", University press (latest edition)
E-RESOURCES:
1. https://en.wikipedia.org >wiki> Conductive polymers
2. www.sae.org/fuel cells/fuelcells-types.htm
3 https://en.wikipedia.org.>wiki> Nanomaterials
4 https://en.wikipedia.org.>wiki> Electrochemical cell
5 https://en.wikipedia.org >wiki> Spectroscopy
o. <u>intpo.//en.wikipedia.org/wiki/opeetioocopy</u>

20A1205302: JAVA PROGRAMMING

(Common to ECE&EEE)

Lectu Pract	ire – ' ical::	Tutoria	1- 2-0	0-2				In	ternal	Marks	:	30
Credi Prere	its: equisit	es:	3					E	kterna	l Marks	s:	70
C Pro	gramı	ning										
Cour	se Obj	ectives	:									
To in	troduc	e the o	bject o	riente	d progr	ammi	ng cono	cepts.				
То ц	nderst	and ob	ject o	rienteo	l prog	rammi	ng con	cepts,	and a	apply th	hem i	n solving
Probl	ems.											
To in	troduc	e the p	rincipl	es of i	nherita	ince ar	nd poly	morph	ism; ar	nd dem	onstra	te how
they a	relate t	o the de	esign o	of abst	ract cla	asses						
To in	troduc	e the ir	npleme	entatio	on of pa	ackage	s and i	nterfac	ces			
To in	troduc	e the c	oncept	s of ex	ception	n hand	lling ar	nd mul	tithrea	ding.		
To in	troduc	e the d	esign o	of Graj	phical	User Ir	nterface	e using	applet	s.		
Cour	se Out	comes:	-	- •								
Upon	succe	ssful c	omple	tion o	f the c	ourse	, the s	tudent	will b	e able f	to:	
CO1	Able 1	to solve	e real w	vorld p	problem	is usir	ig OOP	techni	ques.			
CO2	Able t	to unde	rstand	l the u	ise of a	bstrac	t class	es and	Packag	ges in ja	ava.	
CO3	Able t	to deve l	lop and	d und	erstan	d exce	ption h	andlin	g and I	nterfac	es in j	ava
CO4	Able t	o unde	rstand	multi	thread	ed app	lication	ns with	synch	ronizat	ion an	d design
	GUI b	ased ap	pplicat	ions a	nd dev	elop a	pplets	for wel	o appli	cations		
Cont	ributic	on of C	ourse	Outco	mes to	oward	s achie	eveme	nt of F	rogran	n Out	comes (1
– Lov	v, 2- M	edium,	3 – H	igh)		1					1	
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
001	1	2	3	4	5	6	7	8	9	10	11	12
COI	3	3	-	-	-	-	-	-	-	-	-	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	2	-	-	3
CO4	3	3	3	2	-	-	-	-	2	_	-	3
UNIT	, I											
The I	History	and E	volutio	n of J	ava: Ja	ava's L	ineage	, Java'	s Magi	c: The	Byte of	code, The
Java Progr	Buzzw am, A	ords. A Second	n over 1 Shor	view (t Prog	of Java ram, T	ı: Obje `wo Co	ct-Orie	ented F	rogran	nming,	A First	st Simple
Chara	Arrays acters, natic T	: Java The Pr `ype Pro	Is a rimitive motion	Stron Type n in Ex	gly Ty s, Boo xpressi	ped La leans, ons, A	anguag Variat rrays.	Statem ge, Into bles, Ty	ents. I egers, pe Co	Data Ty Floatin nversio	rpes, V Ig-Poir n and	/ariables, nt Types, Casting,
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UNIT IV

Exception handling: Fundamentals, Exception types, uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws, finally, Java's built-in exceptions, Creating your own exception subclasses.

Multithreaded Programming: The Java thread model, The Main thread, Creating a thread, creating multiple threads, Using isalive() and Join(), thread priorities, Synchronization, Inter thread communication.

UNIT V

APPLETS: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets.

Lab Programs:

1. Create a java application that implements the concept of classes and objects.

- 2. Develop Java Application using inheritance.
- 3. Use interfaces and develop a java application.
- 4. Create a package and access members from a package.
- 5. Develop Java Application using Method overloading and method overriding.
- 6. Create a java application to copy content from one file to another using IO streams.
- 7. Develop Java Application to use String and String Buffer classes
- 8. Implement Exception handling in a given application.
- 9. Develop java application using Multithreading

10. GUI Application using applets

TEXT BOOKS:

1. The Complete Reference Java, 8th edition, Herbert Schildt, TMH.

2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson

Education.

REFERENCE BOOKS:

- 1. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons.
- 2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
- 3. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
- 4. Programming in Java, S. Malhotra, S. Chudhary, 2nd edition, Oxford Univ. Press.
- 5. Java Programming and Object oriented Application Development, R. A. Johnson, Cengage Learning.

E-RESOURCES:

http://www.javatpoint.com/ java.sun.com/docs/books/tutorial/java/TOC.html http://www.learnjavaonline.org/ http://www.tutorialspoint.com/java/ www.java.com/en/download/faq/develop.xml www.oracle.com , Java , Java SE www.w3schools.com

20A1202401: ELECTRICAL CIRCUIT ANALYSIS-1 (Electrical and Electronics Engineering)

Lect	ture -	Tutorial		3_1	1 Hours		Inte	rnal Ma	rke		30	
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✤ T	o stud	ly the co	oncept o	f magnet	tic coup	led circu	lit.					
✤ T	o und	erstand	the beh	avior of	RLC net	works fo	r sinuso	oidal exe	citations.			
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COI												
CO2	Elect	trical ne	tworks v	with netv	work tor	ology co	ncepts.					
		_				<u> </u>						
CO3	Any	magneti	ic circuit	t with va	arious de	ot conve	ntions.					
	Any	PIC	network	with of	nusoido	1 evoitat	ion					
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CO5	Any	R, L, ne	etwork w	vith varia	ation of	any one	of the p	arame	ters i.e R,	L, C a	nd f.	
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circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.

UNIT III

Single Phase A.C Systems

Periodic waveforms (determination of rms, average value and form factor), concept of phasor, phase angle and phase difference – waveforms and phasor diagrams for lagging, leading networks, complex and polar forms of representations. node and mesh analysis. Steady state analysis of R, L and C circuits, power factor and its significance, real, reactive and apparent power, waveform of instantaneous power and complex power.

UNIT IV

Resonance - Locus Diagrams

Series and parallel resonance, selectively band width and Quality factor, locus diagram- RL, RC, RLC with R, L and C variables.

UNIT V

Network theorems (DC & AC Excitations)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem.

Text Book:

1. Engineering Circuit Analysis by William Hayt and Jack E. Kemmerley, 6th edition McGraw Hill Company, 2012.

2. Network Analysis: Van Valkenburg; Prentice-3rd edition, Hall of India Private Ltd, 2015.

REFERENCE BOOKS:

- 1. Fundamentals of Electrical Circuits by Charles K. Alexander and Mathew N.O.Sadiku, 5th edition, McGraw Hill Education (India), 2013.
- 2. Linear Circuit Analysis by De Carlo, Lin, 2nd edition, Oxford publications, 2001.
- 3. Electric Circuits (Schaum's outlines) by Mahmood Nahvi & Joseph Edminister, Adapted by KumaRao, 5th Edition McGraw Hill, 2017.
- 4. Electric Circuits by David A. Bell, 7th edition, Oxford publications, 2009.
- 5. Introductory Circuit Analysis by Robert L Boylestad, 13th edition, Pearson, 2015
- 6. Circuit Theory (Analysis and Synthesis) by A. Chakrabarthi, 7th edition, DhanpatRai&Co., 2018.

E-RESOURCES

1. http://nptel.ac.in/courses.php

2. http://jntuk-coeerd.in/

3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/
20A1201301: Basic Civil and Mechanical Engineering

(Electrical and Electronics Engineering)

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UNIT – I												
SIMPLE	STRES	S AND S	TRAI	NS:								

Definition of Mechanics- External and Internal forces-Stress and Strain-Elasticity and Hooke's

Law- Relations between elastic constants. **SURVEYING:**

Objectives, Types, Principles of Surveying; Measurement of distances and angles

UNIT II:

CIVIL ENGINEERING MATERIALS:

Classification of bricks, Manufacture of bricks, Laboratory and field tests on bricks, stones; Grades of Steel and Cement Concrete.

MASONRY:

Bonds in Brick Masonry, Stone Masonry; Types of Flooring and Roofing.

UNIT III:

SUB-STRUCTURE: Soil –Types; Introduction to Foundations – Classifications; Bearing capacity of Soil - Improvement

Fundamentals of Thermodynamics: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics.

UNIT-IV

Introduction to Engineering materials: Engineering materials, classification - Properties and applications of Metals: Ferrous and Non-ferrous; Non-metals: Glasses- Ceramics; Polymers: PVC &HDPE.

Basic Manufacturing Processes: Casting: Classification, Steps involved in making a casting -Advantage of casting and its applications. Welding: Classification of welding processes, Fundamental treatment of various welding processes.

UNIT-V

System of forces: Types of Force systems - Coplanar Concurrent Forces - Resultant - Moment of a Force -Resultant of a Force System -Conditions of Equilibrium - Equilibrium analysis of Coplanar Force Systems -Free body diagrams.

TEXTBOOKS:

- 1. Strength of Materials by R K Bansal, Laxmi publications.
- 2. Building Materials, S. S. Bhavikatti, Vices publications House private ltd.
- 3. Surveying and levelling, R. Subramanian, Oxford University press
- 4. Basic Civil Engineering, Palanichamy, M. S, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002.
- 5. Thermal Engineering, R.K.Rajput, Laxmi publications.
- 6. A text book of Material science and metallurgy O.P. Khanna/ Dhanpat rai publications.
- 7. Elements of Manufacturing Processes PARASHAR, B.S. NAGENDRA, MITTAL,
- 8. Engineering Mechanics Statics and Dynamics A. K. Tayal, Umesh Publications.

REFERENCE BOOKS:

- 1. Building Materials, S. K. Duggal, New Age International Publications
- 2. Fundamentals of surveying, S.K. Roy PHI learning (P) ltd.
- 3. Thermodynamics An Engineering Approach YunusCengel& Boles /TMH
- 4. Engineering Mechanics, SS Bhavikatti& KG Rajasekharappa, New Age International
- 5. Materials Science and Metallurgy C. Daniel Yesudian, D. G. Harris Samuel.
- 6. Production Technology, K.L.Narayana, S.V.Ramana& P. Vamsi Krishna, first edition, I.K. Books
- 7. Engineering Thermodynamics / PK Nag /TMH International, 2006.
- 8. Production Technology Vol I, O.P. Khanna & M. Lal, Dhanpat Rai Publicati

20A1200801:ENVIRONMENTAL Sciences (Common to CE,EEE,ME and ECE

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CO3	\succ	Recal	l the ir	nporta	nce of	biodive	ersity a	nd its	conser	vation.	(L1)	
CO4	\succ	Sumr	narize	the ro	le of n	atural	resour	ces for	the su	ustena	nce of	f life on
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UNIT I

CO6

3

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(6hrs)

2

2

Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects. Role of information technology in environment and human health.

2

3

2

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem; Producers, consumers and decomposers. - Energy flow in the ecosystem - Food chains, food webs and ecological pyramids- Ecological succession.

UNIT II

(4hrs)

Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity- classification - Value of biodiversity: consumptive use, productive use, social value. India as a mega diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. Endangered and endemic species of India – Conservation of biodiversity.

UNIT III

(7hrs)

Natural Resources: Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest 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.

Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy

sources.

Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT IV

Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his well being.

Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

UNIT V

(6hrs)

(5hrs)

Social Issues and the Environment: Urban problems related to energy, rain water harvesting. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act - Wildlife Protection Act -Forest Conservation Act. Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS. Ecotourism, Green Campus – Green business and Green politics.

TEXT BOOKS:

1) Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014

2)Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada 3) Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.

4) Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

REFERENCE BOOKS:

1) Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.

2) A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi3) Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi

E-RESOURCES: 1. <u>http://nptel.ac.in/courses.php.</u> 2. <u>http://jntuk-coeerd.in/</u>

Terdits 1.5 External Marks: 70 REREQUISITES: None OURSE OBJECTIVES 1. To learn the sound systems of English and understand word stress of English 3. To equip the students in the art of conversation and discussion 3. To equip the students with good communication skills. 4. To emphasize the need of English in the technical world. 5. To improve their presentation and participation skills. 6. To prepare them for interviews and future job environments. OURSE OUTCOMES pon successful completion of the course, the student will be able to: 0 Demonstrate better understanding of the inportance of spoken English to put in use in various situation and events. 0 Apply the rules of phonetics-pronunciation, accent and intonation- in their everyday communication. 0 Relate their understanding of the importance of spoken skills and the need for life-long learning in day-to-day communication. 0 Construct strategies like critical and analytical skills to participate effectively group discussions and debates. 0 Demonstrate their ideas accurately and effectively in presentations. 0 Build responses to the questions by listening to short audio texts and identify the context and specific pieces of information. 0 0 0 <td< th=""><th>Hours/V</th><th>nstruc Veek</th><th>tions</th><th></th><th>3 Hou</th><th>rs</th><th>Int Ma</th><th>ernal arks:</th><th>30</th><th></th><th></th><th></th></td<>	Hours/V	nstruc Veek	tions		3 Hou	rs	Int Ma	ernal arks:	30			
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• Asking for Clarifications, Inviting, Expressing Sympathy, Congratulating,	<pre>thick contribution in the contribution in</pre>	e conte ation c , 2- Mc P O 2 aking espond powels, for ronunc	PONSES xt and f Cour- edium P O 3 Inquin ing to Consor- iation	ries or Reque	e questi fic piece itcome High) PO 5	ons by 1 s of info s toward PO 6 VN phone, Asking nciation,	IT II	eg to sho n. ieveme PO 8	nt of Pro 9 9 1 1 nd Res	p texts a ogram (10 1 1 1 1 2 1 1 ponding m, Com	nd ider	ntify nes PO 12 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 7 12 12 12 12 12 12 12 12 12 12 12 12 12

• Word stress – Di-Syllabic Words, Poly-Syllabic Words, Weak and Strong Forms,
Contrastive Stress (Homographs)
UNIT III
Debating
• Stress in Compound Words, Rhythm, Intonation, Accent Neutralization.
UNIT IV
Group Discussions
• Listening to Short Audio Texts, and Identifying the context and specific pieces of
information to answer a series of questions in speaking.
UNIT V
 Presentation Skills and Interview Skills
 Newspapers reading; Understanding and identifying key terms and structures
useful for writing reports.
Lab Manual: "Infotech English", Maruthi Publications.
Software: k-van solutions Multimedia language lab
REFERENCE BOOKS:
1. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
2. English Pronunciation in use - Mark Hancock, Cambridge University Press.
3. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
4. English Pronunciation in use- Mark Hewings, Cambridge University Press.
5. English Pronunciation Dictionary- Daniel Jones, Cambridge University
Press.
6. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan
Publications
E-RESOURCES
1. <u>https://learnenglish.britishcouncil.org/</u>
2. <u>https://rachelsenglish.com/</u>
3. https://www.bbc.co.uk/learningenglish/

- 4. <u>https://www.engvid.com/</u>
 5. <u>https://bbclearningenglish.com</u>

20A1200294 : AppliedChemistry Lab

110015	Instru	ictions	3						Interna	al Marks	s:	30
Credit	/ WCCK		1.5	5					Extern	al Mark	s:	70
Prerec	uisites	s: Knov	vledge	on Vol	umetri	ic anal	ysis.			<u> </u>		
Cours	e Objec	ctives:					•					
*	To prov	vide kn	owledge	e of che	emistry	, practio	cals.					
*	It enab	les the	studer	its to a	nalyze	the diff	erent pa	aramet	ers of v	vater sai	mple l	ike
•	hardne	ess and	alkalir	nity and	l differe	ent volu	ametric	titratic	ons.		1	
***	It make	es the s	student	s to ob	tain ba	isic kno	owledge	of inst	rument	ation ba	ased of	n
Cours		nt Engi	neering	g applic	ations.							
Cours		Studer	nta of	Fracing	oning	abould	under	ntond	and a	<u>nnl.</u>	1	a and
COI	*	plastic society	techno 7.	ologies	along v	with the	eir utiliz	zation t	to solve	the pro	blems	of the
CO2	*	Knowl to eng	edge of ineerin	f cells a g stude	and ser ents in	nsors u solving	tilized i and ap	n man plying	y instru to batte	uments i eries and	is nec d fuel	essary cells.
CO3	*	Knowl along	edge of with th	electro e meth	ochemic ods of o	cal cells control	s is esse ling to t	ential in oudding	n under g engin	rstandin eers.	g corr	rosion
CO4	*	Stude	nts sho	ould ha	ave the	e know	ledge o	f wate:	r and i	its hard	ness,	boiler
		troubl sustai	es and nability	d prol 7.	blems	associ	ated w	vith tl	ne env	vironmen	nt ar	nd its
CO5	*	Knowl be kno	edge of own by	fuels a the stu	and en idents	ergy, tł to solve	neir ad e and ur	vantag ndersta	es & di Ind eng	sadvant ineering	ages s g probl	should lems.
CO6	*	Knowl Engine	edge, d eering s	lesign a student	and ana ts in so	alysis c lving tł	of mater	rials sh olex pro	ould be	e unders of the so	stood ociety.	by the
Contr	ibution		~			_	1	· · ·			· · · · · · · · · · · · · · · · · · ·	
/	N N <i>R</i> 1 •		urse O	utcome	es towa	ards ac	hieven	ient of	Progra	m Outo	comes	s (1 –
Low, 2	2- Medi	um, 3	urse O – High	utcome)	es towa	ards ac	hievem	ent of	Progra	m Outo	comes	s (1 –
Low, 2	2- Medi PO 1	um, 3 PO 2	urse Ou – High PO 3	utcome) PO 4	es towa	PO	hievem PO 7	PO 8	Progra	PO 10	PO 11	s (1 - PO 12
Low, 2	2- Medi PO 1 3	um, 3 PO 2	urse Or - High PO 3	utcome) PO 4 1	es towa PO 5	ards ac PO 6	PO 7	PO 8	Progra PO 9	PO 10	PO 11	F (1 - PO 12
Low, 2 CO1 CO2	2- Medi PO 1 3 3	um, 3 PO 2 1 3	urse O – High PO 3 1 1	utcome PO 4 1	PO 5	PO 6	PO 7	PO 8	Progra PO 9	PO 10	PO 11	F (1 - PO 12
Low, 2 CO1 CO2 CO3	2- Medi PO 1 3 3	um, 3 PO 2 1 3 2	- High PO 3 1 2	utcome) PO 4 1 -	PO 5	PO 6	PO 7	PO 8	Progra PO 9	PO 10	PO 11	F (1 - PO 12
Low, 2 CO1 CO2 CO3 CO4	2- Medi PO 1 3 3 3 3	ium, 3 PO 2 1 3 2 1 1 3	rse Or - High PO 3 1 1 2 -	utcom() PO 4 1 - 1	PO 5	PO 6	PO 7	PO 8	Progra PO 9	PO 10	PO 11	F (1 - PO 12 - 12 - 12 - 12 - 12 - 12 - 12 - 12
Low, 2 CO1 CO2 CO3 CO4 CO5	2- Medi PO 1 3 3 3 3 3 3	um, 3 PO 2 1 3 2 1 2 1 2	- High PO 3 1 2 - 2	utcom() PO 4 1 - - 1 1	PO 5	PO 6	PO 7	PO 8	Progra PO 9	PO 10	PO 11	F (1 - PO 12
Low, 2 CO1 CO2 CO3 CO4 CO5 CO6	2- Medi PO 1 3 3 3 3 3 3 3 3	Image: second	- High PO 3 1 1 2 - 2 1	utcom() PO 4 1 - - 1 1 1 1	PO 5	PO 6 	PO 7	PO 8	Progra PO 9	PO 10	PO 11	s (1 - PO 12
Low, 2 CO1 CO2 CO3 CO4 CO5 CO6 1.Intro standa etc. 2. Det 3. Det 4. Det 5. Det 6. Det 7. Esti 8. Det 9. Con 10. Po 11. Pro 12. De	2- Medi PO 1 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	aum, 3 PO 2 1 3 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1	 High PO 3 1 1 2 - 2 1 - 2 - 2 1 - <l< td=""><td>PO 4 1 - 1 1 1 y labora etric tit: ing stan ity of a using ardness ing stan ity of a using ardness ing stan of a colo h betwee betwee of wate</td><td>PO 5 List of atory – rations ndard I sample standa s of wat ndard I rimetri een strop en strop r samp</td><td>PO 6 6 Exper Molarit , Quan Na₂CO₃ e conta rd Oxa ter usin K₂Cr₂O c meth ong acid ng acid le</td><td>PO 7 7 iments ty, Norn titative solution ining Na lic acid ng stand 7 solution od using d and str</td><td>PO 8 8 nality, 1 analys n. a₂CO₃ a solutio lard EI on g thioc trong b cong ba</td><td>Progra PO 9 Primary is, Qua and Na on. DTA solution yanates ase. use.</td><th>PO 10 10 7, secon litative a OH. ution.</th><th>PO 11 analys</th><td>s (1 - PO 12 </td></l<>	PO 4 1 - 1 1 1 y labora etric tit: ing stan ity of a using ardness ing stan ity of a using ardness ing stan of a colo h betwee betwee of wate	PO 5 List of atory – rations ndard I sample standa s of wat ndard I rimetri een strop en strop r samp	PO 6 6 Exper Molarit , Quan Na ₂ CO ₃ e conta rd Oxa ter usin K ₂ Cr ₂ O c meth ong acid ng acid le	PO 7 7 iments ty, Norn titative solution ining Na lic acid ng stand 7 solution od using d and str	PO 8 8 nality, 1 analys n. a ₂ CO ₃ a solutio lard EI on g thioc trong b cong ba	Progra PO 9 Primary is, Qua and Na on. DTA solution yanates ase. use.	PO 10 10 7, secon litative a OH. ution.	PO 11 analys	s (1 - PO 12

PH meters, Potentiometers, Conductometers, colorimeters. **APPARATUS**

Burettes, Pipettes, Conical flask, Beakers, Volumetric flask.

REFERENCE BOOKS:

1 . A Textbook of Quantitative Analysis, Arthur J. Vogel.

2. Dr.JyotsnaCherukuri (2012) Laboratory Manual of engineering chemistry-II, VGSTechno Series

3. Chemistry Practical Manual, Lorven Publications

4. K. Mukkanti (2009) Practical Engineering Chemistry, B.S. Publication

20A1201391: Basic Civil and Mechanical Engineering Lab (Electrical and Electronics Engineering)

practi	ical		ЗH	lours]	nterna	al Mark	s:	30
Credi	ts:		1.5	5				I	Extern	al Mark	s:	70
Prere	quisite	s:										
Cours	se Obje	ctives:										
1)	To ma	ke the	studen	ts outl	ine the	proces	s of ide	entifica	tion of	various	build	ing
СС	ompone	ents										
2)	To ma	ke the	studen	ts expo	osed to	the ope	eration	of the	various	s survey	y instr	uments
u	sed for	linear	measur	rement	s.							
3)	To ma	ke the	studen	ts expo	osed to	the ope	eration	of the	various	s survey	y instr	uments
u	sed for	angula	r meas	ureme	nts.							
4)	To intr	oduce	the con	cepts o	of ferror	us and	Non Fe	errous	materia	als		
5)	To int	roduce	the con	ncepts	of prim	nary ma	nufact	uring p	process	es.		
Cours	se Outo	comes:										
Upon	succes	ssful co	omplet	ion of	the co	urse, t	he stu	dent w	ill be a	able to:		
CO1	Under	rstand	various	surve	y equip	oment's	like ch	nain, ta	pe, cro	ss-staff	and c	ompass
CO2	De	Dete	rmine	distan	ces ar	nd irre	egular	areas	using	conver	ntional	survey
	instru	iments										
CO3]	Demon	strate v	various	buildi	ng mate	erials					
CO4	Obser	ve the	micro s	structu	re of di	ifferent	materi	als.				
CO5	Under	rstand	mold p	repara	tion							
CO6	Desig	n the d	ifferent	types	of weld	l joints	and op	perate t	he weld	1 machi	ines	
Conti	ributio	n of Co	ourse C	outcon	ies tow	vards a	chieve	ment	of Prog	gram O	utcom	es (1 –
Low,	2- Med	lium, 3	– Higl	1)								
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
~ ~ 1	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	1	3	-	-	-	-	-	-	-	-
CO2	3	2	-	2	-	-	-	-	-	-	-	-
CO3	3	2	1	2	-	-	-	-	-	-	-	-
CO4	3	2	_	2	_	-	-	-	-	-	-	-
CO5	3	2	1	3	_	-	-	-	-	-	-	-
CO6	3	2	1	3	-	-	-	-	-	-	-	-
					List o	of Expe	rimen	ts				
Ci	vil par	t:										
1.	Demor	nstratio	n on u	sage of	chain							
2.	Rangir	ng – offs	sets – c	hain-a	ge							

3. To find the area of an irregular polygon using chain by using horizontal measurements

4. Determination of bearings with prismatic compass.

5.Determination of included angles with prismatic compass

6. Demonstration on various Building materials used in construction

Mechanical part:

- 1. Study of the micro structure of steels.
- 2. Study of the micro structure of Cast Irons.
- 3. Mould preparation, Melting and Casting
- 4. Gas cutting
- 5. Manual metal arc welding Lap & Butt Joints
- 6. Resistance Spot Welding

REFERENCE BOOKS:

1.U.C Jindal and Atish Mozumber, Material science and metallurgy, Pearson education-2012

2. Elements of Manufacturing Processes -, B.S. NAGENDRA PARASHAR, MITTAL

3 .Production Technology Vol I, O.P. Khanna & M. Lal, Dhanpat Rai Publicati 4. A text book of Material science and metallurgy – O.P. Khanna/ Dhanpat rai

publications.

5. Laboratory Manual for Basic Civil and Mechanical Engineering workshops

20A1202491: ELECTRICAL ENGINEERING WORKSHOP (Electrical and Electronics Engineering)

	Pract	ical:		3	Hours		Int	ernal Ma	rks:		30	
	Cred	lits			1.5		Ext	ernal Ma	arks:		70	
Pre	requisi	tes: Thi	is labor	atory in afety me	troduces	s the h	basic co	ncepts	of elec	trical e	ngineer Electri	ing
Eng	gineeri	ng disci	pline.	arety me	asures	which is	s the lo	unuatio	II IOI AII	1405 01	Diccur	Cai
					Cours	se Objec	tives					
*	To den	nonstrat	e the us	age of m	easuring	equipm	ent					
*	To trai	n the st	udents i	n setting	g up simp	ole wirin	g circuit	s				
*	To imp	oart metl	hods in e	electrical	machine	e wiring						
					Cours	se Outco	mes					
		Upon	success	ful comp	letion of	the cou	se, the s	tudent v	will be ab	le to:		
CO1	Expla	ain the lin	nitations	of electri	cal systen	ns and w	iring.					
CO2	Expla	in the to	lerances	of electri	cal systen	ns and w	iring.					
соз	Expla	ain the sa	fety aspe	ects of ele	ectrical sys	stems an	d wiring.					
CO4	. Sele	ect wires	/cables ar	nd other a	accessorie	es used ir	n differen	it types o	of wiring.			
CO5	Make	e simple l	lighting a	nd powei	r circuits.							
C06	Meas	sure curr	ent, volta	ige and p	ower in a	circuit						
	C	Contribu	tion of C	ourse Ou	tcomes t	owards a	chievem	ent of P	rogram (Outcome	s	
	PO	PO	PO	1) PO	– LOW, 2-	PO			PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	2						1			
CO2	3	3	2						1			
СОЗ	3	3	2						1			
CO4	3	3	2						1			
CO5	3	3	2						1			
C06	3	3	2						1	_		
			1	1	List of	f Experir	nents	1	ı — I		1	I
Any 10	of the f	following	g experin	ients are	to be co	nducted	:					
1. Stud	y of va	arious ele	ectrical t	ools and	symbols							
2. Stud	y vario	ous types	s of elect	rical cal	oles/wires	s, switcl	nes, fuse	s, fuse o	carriers.	MCB. E	LCB. R	CCB
and MC	CCB wi	ith their	specifica	ations an	d usage.	,	,	,	, -	. , -	, 1	
3. Solde	ering a	nd de-so	oldering	oractice.								
4. Ident	tificatio	on of va	rious tvr	bes of re	sistors a	nd capao	citors an	d under	stand the	e usage	digital r	nulti-
meter.			-71			T.					J	
5. Ident	ificatio	on of var	rious sen	niconduc	tor devic	es.						
I	_			-								

6. Study of Moving Iron, Moving Coil, Electrodynamic and Induction type meters.

7. Fluorescent lamp wiring.

- 8. Wiring of lighting circuit using two way control.(stair case wiring)
- 9. Godown wiring/ Tunnel wiring
- 10. Hospital wiring.
- 11. Measurement of voltage, current, power in DC circuit.
- 12. Wiring of power distribution arrangement using single phase MCB distribution board with
- ELCB, main switch and energy meter for calculating Power and Power Factor.
- 13. Measurement of earth resistance.
- 14. Wiring of backup power supply for domestic Installations including inverter, battery and load.
- 15. Troubleshooting of domestic electrical equipment's (tube light and fan).
- 16. Understand the usage of CRO, function generator. & Regulated power supply and Measurement of ac signal parameters using CRO.
- 17. Assembling electronic components on bread board.
- 18. Obtain V-I characteristics of Light Emitting Diode

REFERENCE BOOKS:

1.U.C Jindal and Atish Mozumber, Material science and metallurgy, Pearson education-2012

2. Elements of Manufacturing Processes -, B.S. NAGENDRA PARASHAR, MITTAL

3 .Production Technology Vol I, O.P. Khanna & M. Lal, Dhanpat Rai Publicati

4. A text book of Material science and metallurgy - O.P. Khanna/ Dhanpat rai publications.

VECTOR CALCULUS, FOURIER TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

Lectu	re – Tı	itoria	1:	3	-1 Hou	ırs		Int	ernal	Marks	:	30
Credi	ts:			3				Ext	ernal	Marks	:	70
Cours	se Obje	ctives	5:									
\triangleright	To fam	iliarize	the co	mplex	variat	oles.						
\succ	To fami	iliarize	the st	udents	s with	the fou	ndatio	ons of p	robab	ility and	l statis	tical
	method	ls										
\succ	To equi	p the s	studen	ts to s	olve ap	oplicati	on pro	blems	in the	ir discip	lines.	
Course	e Outcor	nes										
Upon	n succ	essfu	ıl cor	nple	tion (of the	e cou	rse, t	he s	tuden	t will	be able
to:				-				·				
CO1	To fan	niliariz	e the c	omple	x varia	bles						
CO2	To fan	niliariz	e the r	esidue	e theor	em						
CO3	To fan	niliariz	e the s	tuden	ts with	the fo	undati	ions of	proba	bility m	ethods	
CO4	To fan	niliariz	the s	tuden	ts with	the fo	undati	ions of	statist	ical me	thods	
CO5	To equ	ip the	stude	nts to	solve a	applica	tion pr	oblems	s in th	eir disci	plines	
CO6	To Per	form va	tious te	ests		4		- 1- 3		of Dec		0
(1 - Lo	bution w. 2- Ma	OI () oium.	3 – Hi	outo whi	comes	towar	as a	cnieven	ient	01 Pro	ogram	Outcomes
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3										1	
CO2	3										1	
CO3	3										1	
CO4	3										1	
C05	3										1	
C06	3										1	
CO3 CO4 CO5 CO6	3 3 3 3										1 1 1 1	

UNIT I

Functions of a complex variable and Complex integration:

Introduction – Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method. Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula (all without proofs) and problems on above theorems.

UNIT II

Series expansions and Residue Theorem:

Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Types of Singularities: Isolated – Essential –Pole of order m–Residues – Residue theorem (without proof) – Evaluation of real integral of the types f x dx () $\infty \infty$ –J and

UNIT III

Probability and Distributions:

Review of probability and Baye's theorem - Random variables - Discrete and

Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

UNIT IV

Sampling Theory:

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Representation of the normal theory distributions – Introduction to t, 2 χ and F-distributions – Point and Interval estimations – Maximum error of estimate.

UNIT V

Tests of Hypothesis:

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions.

TEXT BOOKS:

B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
 Miller and Freund's, Probability and Statistics for Engineers, Pearson, 7th edition, 2008.

REFERENCE BOOKS:

1.J. W. Brown and R. V. Churchill, Complex Variables and Applications, 9th edition, Mc-Graw Hill, 2013.

2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & Sons Publications, 2012.

3. Jay l. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.

4. Shron L.Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.

5. Sheldon, M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4thEdition, Academic Foundation,2011

ELECTRONIC DEVICES AND CIRCUITS

Lecture –		3-1 H	lours		I	ntern	al Ma	rks:		30		
Credits:				3			E	xtern	al Ma	rks:		70
Course Ob	jectiv	ves:										
> The l	basic d	concep	ots of s	semico	onduct	or ph	ysics a	are to b	oe revi	ewed.		
> Stud	y the	physi	cal pl	henon	nena s	uch a	as cor	nductio	on, tra	ansport	mecha	anism and
elect	rical c	haract	eristi	cs of d	lifferen	t dioc	les.					
 The application of diodes as rectifiers with their operation and characteristics with and without filters are discussed. The principle of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics are explained. The need of transistor biasing and its significance is explained. The quiescent point 											ristics with	
and	withou	ıt filter	rs are	discu	ssed.							
> The	princi	ple of	worki	ing ar	nd oper	ration	ı of Bi	polar .	Juncti	ion Tra	nsistor	and Field
Effec	t Tran	sistor	and t	heir c	haract	eristic	es are	explair	ned.			
The need of transistor biasing and its significance is explained. The quiescent poin or operating point is explained.										scent point		
 The need of transistor biasing and its significance is explained. The quiescent point or operating point is explained. Small signal equivalent circuit analysis of BJT and FET transistor amplifiers in different configuration is explained. 												
 The principle of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics are explained. The need of transistor biasing and its significance is explained. The quiescent point or operating point is explained. Small signal equivalent circuit analysis of BJT and FET transistor amplifiers in different configuration is explained. Course Outcomes Upon successful completion of the course, the student will be able to: Study the basic concepts of semiconductor physics are to be reviewed 										nplifiers in		
differ	 Effect Transistor and their characteristics are explained. The need of transistor biasing and its significance is explained. The quiescent point or operating point is explained. Small signal equivalent circuit analysis of BJT and FET transistor amplifiers in different configuration is explained. Ourse Outcomes Fpon successful completion of the course, the student will be able O1 Study the basic concepts of semiconductor physics are to be reviewed O2 Study the physical phenomena such as conduction, transport mechanism											
Course Outo	Small signal equivalent circuit analysis of BJT and FET transistor amplifiers in different configuration is explained. se Outcomes In successful completion of the course, the student will be able Study the basic concepts of semiconductor physics are to be reviewed											h h 1 .
Upon su	comes ccessful completion of the course, the student will be able											
to:	cessful completion of the course, the student will be able											
C01	on successful completion of the course, the student will be able1Study the basic concepts of semiconductor physics are to be reviewed2Study the physical phenomena such as conduction, transport mechanism											
02	and e	electri	cal ch	aracte	eristics	of dif	ferent	diodes	, 11011,	uanspo	nt mee	namsm
CO3	Stud	y the a	applic	ation	of diod	es as	rectifi	ers wit	h thei	r opera	tion an	d
	chara	acteris	stics w	vith ar	nd with	out fi	lters			-		
CO4	Study	the p	rincip	le of w	vorking	g and	operat	tion of	Bipola	ar Junc	tion Tra	ansistor
<u> </u>	and	Field E	<u>Effect</u>	Trans	istor ai	nd the	eir cha	racter	stics			
205	Study	/ the h	eeu oi	or one	rating	noint	s and i	us sign	mcan	ce is ex	plained	i. ine
CO6	Expla	in Sm	all sig	mal ec	uivale	nt cir	cuit ar	nalvsis	of BJ'	T and F	ET tra	nsistor
	ampl	ifiers	in diff	erent	configu	iratio	n	5				
Contributio	n of	Cour	se C	Outcor	nes t	oward	ls ac	hievem	ent	of Pro	ogram	Outcomes
(1 - Low, 2 -	PO	m, 3 – PO	Hign)	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
C01	3											
CO2	3	2										
CO3	3	2										
	3	2										
C05		2			$\left \right $							
	3											

UNIT I

Semi-Conductor Physics: Insulators, Semiconductors, and Metals, classification using energy band diagrams, mobility and conductivity, electrons and holes in intrinsic semiconductors, extrinsic semiconductors, drift and diffusion, charge densities in semiconductors, Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors **Junction Diode Characteristics:** Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance, energy band diagram of PN junction Diode.

UNIT II

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Photodiode, Tunnel Diode, SCR, UJT. Construction, operation and characteristics of all the diodes are required to be considered.

Rectifiers and Filters: Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter, Capacitor filter, comparison of various filter circuits in terms of ripple factors.

UNIT III

BJT: Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

FET: FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

UNIT IV

Transistor Biasing and Thermal Stabilization: Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in VBE, Ic, and β , Stability factors, (S, S', S''), Bias compensation, Thermal runaway, Thermal stability. FET Biasing-methods and stabilization.

UNIT V

Small Signal Low Frequency Transistor Amplifier Models: BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers. FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

TEXT BOOKS:

1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 2nd Edition, 2010.

2.Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson/Prentice hall, 10thedition, 1999.

REFERENCE BOOKS:

1. Electronic Devices and Circuits-K. Satya Prasad, VGS Book Links, 2nd Edition, 2006.

2. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, 2nd Edition, 2018.

3. Electronic Devices and Circuits - David Bell, Oxford, 5th Edition, 2008.

ELECTRICAL CIRCUIT ANALYSIS-II

Lectu	re – T	uto	rial:		3-1	Hours			Inte	rnal N	Iark	5:		30
Credi	ts:				3				Exte	rnal I	Mark	s:		70
Cours	se Obj	ecti	ves:											
\checkmark	To stu	ıdy t	he co	ncept	s of p	passive	elem	ents, 1	types	of so	urces	and v	rariou	as network
	reduct	tion	techni	iques.										
\succ	To une	derst	and t	he ap	plicat	tions of	fnetw	ork to	polog	y to el	ectric	al circ	uits.	
\succ	To stu	ıdy tl	ne cor	icept	of ma	gnetic	coupl	ed ciro	cuit.					
\succ	To une	derst	and t	he be	havio	r of RL	C net	vorks	for si	nusoi	dal ex	citatio	ons.	
\succ	To study the performance of R-L, R-C and R-L-C circuits with variation of one of													
	the pa	iram	eters a	and to	o und	erstan	d the o	concep	pt of r	resona	nce.			
\succ	To un	nders	tand	the a	applic	ations	of n	etworł	c the	orems	for	analys	sis o	f electrical
	netwo	rks.												
Course	e Outco	omes												
Upon	n suc	ces	sful	com	plet	ion o	f the	e cou	ırse,	the	stu	dent	will	be able
to:														
CO1	Study	y the	conce	epts o	of pass	sive ele	ements	s, type	es of s	source	s and	variou	is ne	etwork
	reduc	ction	techr	niques	8									
CO2	Unde	rstar	nd the	e appl	icatio	ns of n	etwor	k topo	ology 1	to elec	trical	circui	ts	
CO3	Study	r the	conce	pt of	magn	etic co	upled	circui	.t		1			
C04	Unde	rstar	nd the	e beha	$\frac{1}{2}$	$\frac{\text{DI RLC}}{\text{DI D}}$	netwo	TKS 10	$r \sin \theta$	1solda	l exci	tations	$\frac{3}{5}$	and of the
005	Darar	y the	perio	finan 1 to 11	ce oi nders	K-L, K· tand ti	-C and	l K-L- cent o	C CIIC	uits w	/1111 Va	ariatio	11 01 0	one of the
CO6	Unde	rstar	nd the	e appl	icatio	$\frac{1}{1}$ ns of n	etwor	k theo	rems	for ar	nalvsi	s of ele	ectric	al
	netwo	orks									j =			
Contri	bution	of	Cou	rse	Outco	omes	towar	ds a	chiev	ement	of	Prog	ram	Outcomes
(1 – Lo	w, 2- №	<u>lediu</u>	$\frac{m, 3}{2}$	- High	l)	DO	DO	DO		DO		DO		DO
		PO 1	PU 2	3	PO 4	PO 5	P0 6	P0 7	8	9 9	10	11		PO 12
CO	1	3	3	Ŭ	•	U	•	-		-	10			12
CO2	2	3	3											
COS	3	3	2											
CO4	1	3	3		_									
COS	5	3	3											
COe	6	3												

UNIT I

Balanced and Unbalanced Three phase circuits

Analysis of three phase balanced circuits: Phase sequence, star and delta connection of sources and loads, relation between line and phase voltages and currents, analysis of balanced three phase circuits, measurement of active and reactive power.

Analysis of three phase unbalanced circuits: Loop method, Star-Delta transformation technique, two-wattmeter method for measurement of three phase power.

UNIT II

Transient Analysis in DC Circuits Transient response of First order (R-L, R-C) and second order (R-L-C) circuits using differential equations.

Transient response of First order (R-L, R-C) and second order (R-L-C) circuits using Laplace transforms.

UNIT III

Transient Analysis in AC circuits

Transient response of First order (R-L, R-C) and second order (R-L-C) circuits using differential equations.

Transient response of First order (R-L, R-C) and second order (R-L-C) circuits using Laplace transforms.

UNIT IV

Two Port Networks

Two port network parameters – Z, Y, ABCD and Hybrid parameters and their relations, cascaded networks.

UNIT V

Filters

Need of Filters – Classification -Characteristic impedance- Low Pass Filter, High Pass Filter, Band Pass Filter, Band Stop or Band Elimination Filter, m-Derived Filter, Composite filters– Design of Filters.

TEXT BOOKS:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley, McGraw Hill Company,9thedition, 2018.

2. Network analysis: Van Valkenburg: Prentice-Hall of India Private Ltd, 3rd edition, 2019.

REFERENCE BOOKS:

1. Fundamentals of Electrical Circuits by Charles K.Alexander and Mathew N.O.Sadiku, McGraw Hill Education (India), 6th edition, 2019.

2. Introduction to circuit analysis and design by Tildon H Glisson. Jr, Springer Publications, 1st edition, 2011.

3. Circuits by A.Bruce Carlson, Cengage Learning Publications, 1st edition, 2008.

4. Network Theory Analysis and Synthesis by SmarajitGhosh, PHI publications, ninth print, 2015.

5. Networks and Systems by D. Roy Choudhury, New Age International publishers, 2nd edition, 2013. 6. Electric circuit by Joseph Edminister, Schaum's outlines series, seventh edition, 2017.

7. Electric Circuits by David A. Bell, Oxford publications, 7th edition, 2009.

8. Circuit Theory (Analysis and Synthesis) by A.Chakrabarthi, DhanpatRai&Co, 7th - Revised edition, 2018)

DC MACHINES AND TRANSFORMERS

Lect	ure –	Tuto	rial:	3	-1 Hours		Int	ernal	Marks	5:		30
Cred	lits:			3	}		Ext	ternal	Mark	s:	۲ ۱	70
Cour	rse Ol	ojectiv	ves:									
\succ	To l	Jnder	stand	the co	onstruction	ı, princ	iple o	of oper	ration	and p	erforr	nance of
	DC	mach	ines.									
\succ	To I	Learn	the c	haract	teristics, p	erform	ance,	meth	ods of	speed	d con	trol and
	testi	ing m	ethod	s of D	C motors.							
\succ	То	prede	termir	ne the	e perform	ance o	of sin	ngle p	ohase	trans	forme	ers with
	equi	valen	t circu	iit mo	dels.							
\succ	To	Under	stand	the m	ethods of	testing	of sin	igle-pł	nase tr	ansfor	mer.	
\succ	То	Analy	ze the	three	e phase tra	ansforn	ners a	and ad	chieve	three	phas	e to two
	pha	se con	versio	on.								
Cours	se Out	comes										
Upo	n su	ccess	sful c	omp	letion of	the c	ours	e, th	e stud	lent	will 1	be able
to:												
CO1	Unde	erstan	d the	const	ruction, pi	rinciple	of or	peratio	n and	perfor	rmano	ce of DC
	macl	hines										
CO2	Lear	n the	chara	cterist	ics, perfor	mance,	meth	ods of	speed	contr	ol an	d testing
	meth	nods o	f DC r	notors	i							
CO3	Pred	eterm	ine th	e perf	ormance o	f single	e pha	se tra	nsform	ers w	ith eq	luivalent
	circu	iit mo	odels									
CO4	Unde	erstan	d the	metho	ds of testi	ng of si	ngle-j	phase	transf	ormer		
CO5	Anal	yze th	e thre	e phas	se transfor	mers						
CO6	Achi	eve th	ree ph	nase to	two phas	e conve	rsion					
Contr	ributio	n of	Cour	se O	utcomes t	owards	achi	evemer	nt of	Progr	am (Outcomes
(1 – L	.ow, 2-	Mediu	m, 3 –	High)			DO	DO	DO	DO	DO	DO
		PO 1	2	3	4 5	, PO 6	7	PO 8	9	PO 10	PO 11	12
CC	D1	3	2	_								
CC)2	3	2									
CC)3	3	2									
)4)5	3	0									
)6	3	2 2									
		9	4	l								

UNIT I

Electromechanical Energy Conversion and introduction to DC machines

Principles of electromechanical energy conversion - singly excited and multi excited systems- calculation of force and torque using the concept of co-energy. Construction and principle of operation of DC machines – EMF equation for generator – Excitation techniques– characteristics of DC shunt generator – applications of DC Generators

UNIT II

Operation of DC motors

Back-emf and torque equations of dc motors – Armature reaction and commutation – characteristics of separately-excited, shunt, series and compound motors – losses and efficiency – applications of dc motors. Necessity of a starter – starting by 3 point and 4-point starters.

UNIT III

Speed Control of motors and Testing of DC Machines

Speed control by armature voltage and field control – testing of DC machines – brake test, Swinburne's method – principle of regenerative or Hopkinson's method – retardation test – field's test- separation of losses.

Single-phase Transformers

Types and constructional details – principle of operation –emf equation – operation on no load and on load – lagging, leading and unity power factors loads –phasor diagrams of transformers – equivalent circuit.

UNIT IV

Performance and testing of transformers and auto transformers: Regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency. Tests on single phase transformers – open circuit and short circuit tests – Sumpner's test – separation of losses – parallel operation with equal voltage ratios – auto transformer – equivalent circuit – comparison with two winding transformers.

UNIT V

3-Phase Transformer: Polyphase connections- Y/Y, Y/ Δ , Δ /Y, Δ / Δ and open Δ -third harmonics in phase voltages – three winding transformers- transients in switching –off load and on load tap changers- Scott connection.

TEXT BOOKS:

1. Electrical Machines by P.S. Bhimbra, Khanna Publishers, 7th edition, 2011.

2. Electric Machinery by A.E.Fitzgerald, Charleskingsley, Stephen D.Umans, TMH, 6 th edition, 2003.

REFERENCE BOOKS:

1. Electrical Machines by D. P.Kothari, I. J. Nagarth, McGraw Hill Publications, 4th edition, 2010.

2. Electrical Machines by R.K.Rajput, Lakshmi publications, 5th edition.

3. Electrical Machinery by Abijith Chakrabarthi and Sudhipta Debnath, McGraw Hill, 1st edition.

4. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education, 4 th edition, 2010.

5. Electric Machines by MulukutlaS.Sarma & Mukeshk Pathak, CENGAGE Learning, 1 st edition, 2008.

6. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria& Sons, 1st edition, 2009.

ELECTRO MAGNETIC FIELDS

Lecture -	Tutorial:		3-1 Houi	rs	Intern	al Marks:		30	
Credits:			3		Extern	nal Marks:		70	
Course O	bjectives:								
> To	study the	produ	ction of	electric	field and	potentials	due to	o different	
con	figurations	of stat	tic charg	es.					
> To	study the	e prop	oerties c	of condu	ctors and	d dielectric	s, calc	culate the	
cap	acitance c	of diff	erent c	onfigurat	tions. Ui	nderstand	the co	oncept of	
con	duction and	d conv	ection cı	arrent de	nsities.				
> To	study th	ie ma	agnetic	fields p	roduced	by currer	nts in	different	
con	figurations	appli	cation of	f Ampere	's law an	d the Maxv	vell's se	econd and	
thir	d equations	8.							
> To	study the	magne	tic force	and tore	lue throu	gh Lorentz	force eq	quation in	
mag	gnetic field	enviro	nment li	ke condu	ctors and	other curre	ent loop	s.	
> To	develop the	e conc	cept of s	self and	mutual i	nductances	and t	he energy	
stor	ed.								
> To	study tim	e vary	ing and	Maxwel	l's equati	ons in diff	erent f	orms and	
Max	cwell's four	th equa	ation for	the indu	ced EMF				
Course Out	comes		1-43-0	- f 4 h				1 4 4 1 -	
Opon su	ccessiui	comp	letion	of the c	course,	the stude	nt will	be able	
CO1	student wil	l he ah	le to Com	nute elec	tric fields	and notential	s 11sing	Gauss law	
	or solve	Laplace	e's or P	oisson's	equations	for variou	s elect	ric charge	
	distributior	18.			- 1			8-	
CO2	student wi	ll be a	able to (Calculate	the capa	citance and	energy	stored in	
	dielectrics								
CO3	student wil	1 be at	ole to Cal	culate th					
	carrying co			iouiaco tii	e magnetio	e field intens	ity due	to current	
		carrying conductor and understanding the application of Ampere's law,							
004	Maxwell's s	econd a	or and third	understan	e magnetic	e field intens application	of Am	to current pere's law,	
CO4	Maxwell's s student wil	econd a l be ab	or and third and third le to Esti-	understan law. imate self	e magnetic ding the	c field intens application al inductance	of Amp	to current pere's law, the energy	
CO4	Maxwell's s student wil stored in th	econd a l be ab le magr	or and mand third and third le to Estimatic field	understan law. imate self	e magnetic ding the	e field intens application al inductance	of Amp	to current pere's law, the energy	
CO4 CO5 CO6	Maxwell's s student wil stored in th student wil student wil	econd a l be ab le magr l be ab l be ab	or and third and third le to Esti- netic field le to Undo le to Poyr	understan law. imate self erstand th nting theor	e magnetic ding the and mutu ne concepts rem and Po	e field intens application al inductance s of displacer	ity due of Amp ces and nent cur r	to current pere's law, the energy rrent	
CO4 CO5 CO6 Contributio	Maxwell's s student wil stored in th student wil student wil	econd a l be ab le magr l be ab l be ab l be ab	or and third and third le to Esti- netic field le to Undo le to Poyn utcomes	understan law. imate self erstand th nting theor towards	e magnetic ding the and mutu ne concepts cem and Po achiever	e field intens application al inductance s of displacer bynting vecto nent of P	ity due of Amp ces and nent cur r r rogram	to current pere's law, the energy rrent Outcomes	
CO4 CO5 CO6 Contributio (1 - Low, 2	Maxwell's s student wil stored in th student wil student wil on of Cou Medium, 3	econd a l be ab le magr l be ab l be ab l be ab rse O - High)	or and mand third and third and to Estimate to Estimate the to Estimate to Estimate the to Under the to Poyre putcomes	understan law. imate self erstand th nting theor towards	e magnetic ding the and muture concepts cem and Po achiever	e field intens application al inductance s of displacer oynting vecto nent of P	ity due of Amp ces and nent cu: r rogram	to current pere's law, the energy rrent Outcomes	
CO4 CO5 CO6 Contributio (1 - Low, 2	Maxwell's s student wil stored in th student wil student wil on of Cou Medium, 3 PO PO 1 2	econd a l be ab l be ab l be ab l be ab rse O - High) PO 3	or and third and third le to Esti- netic field le to Unde le to Poyn vutcomes	understan law. imate self erstand th ting theor towards PO PO 5 6	e magnetic ding the and muture concepts cem and Po achiever PO PO 7 8	c field intens application al inductance s of displacer oynting vecto nent of Pr p PO PO 9 10	ity due of Amp ces and nent cu: r rogram PO 11	to current pere's law, the energy rrent Outcomes PO 12	
CO4 CO5 CO6 Contributio (1 - Low, 2 CO1	Maxwell's s student wil stored in th student wil student wil on of Cou Medium, 3 PO PO 1 2 3 2	econd a l be ab le magr l be ab l be ab l be ab l be ab l be ab 	or and third and third le to Esti- netic field le to Unde le to Poyn rutcomes	understan law. imate self erstand th nting theor towards PO PO 5 6	e magnetic ding the and muture concepts cem and Po achiever PO PO 7 8	c field intens application al inductances of displacer oynting vecto nent of Pro 9 10	ity due of Amp ces and nent cu: r rogram PO 11	to current pere's law, the energy rrent Outcomes PO 12	
CO4 CO5 CO6 Contributio (1 - Low, 2 CO1 CO2	Maxwell's s student wil stored in th student wil student wil on of Cou Medium, 3 PO PO 1 2 3 2 3	econd a l be ab l be ab l be ab l be ab rse 0 - High) PO 3	or and third and third le to Esti- netic field le to Unde le to Poyn PUtcomes PO	understan law. imate self erstand th nting theor towards PO PO 5 6	e magnetic ding the and muture concepts cem and Po achiever PO PO 7 8	e field intens application al inductance s of displacer oynting vecto nent of Pr 9 10	ity due of Amp ces and nent cu: r rogram PO 11	to current pere's law, the energy rrent Outcomes PO 12	
CO4 CO5 CO6 Contributio (1 - Low, 2 CO1 CO2 CO3	Maxwell's s student wil stored in th student wil student wil on of Cou Medium, 3 PO PO 1 2 3 2 3 2 3 2 3 2	econd a l be able magn l be able l be able rse O - High) PO 3	or and third and third le to Esti- netic field le to Unde le to Poyn vutcomes	understam law. imate self erstand th iting theor towards PO PO 5 6	e magnetic ding the and mutu ne concepts cem and Po achiever 7 8	e field intens application al inductance s of displacer bynting vecto nent of Pr D PO PO 9 10	ity due of Amp ces and ment cu: r rogram PO 11	to current pere's law, the energy rrent Outcomes PO 12	
CO4 CO5 CO6 Contributio (1 - Low, 2 CO1 CO2 CO3 CO4 CO5	Maxwell's s student wil stored in th student wil student wil on of Cou Medium, 3 PO PO 1 2 3 2 3 2 3 2 3 3 3 2 3 3 3 3	econd a l be ab l be ab l be ab l be ab l be ab rse O - High) PO 3	or and third and third le to Esti- netic field le to Unde le to Poyn vutcomes PO	understan law. imate self erstand th nting theor towards PO PO 5 6	e magnetic ding the and muture concepts cem and Po achiever PO PO 7 8	e field intens application al inductance s of displacer oynting vecto nent of Pr 9 10	ity due of Amp ces and nent cur r rogram PO 11	to current pere's law, the energy rrent Outcomes PO 12	

UNIT I

Electrostatics:

Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge, work done in moving a point charge in an electrostatic field, electric potential – potential gradient, Gauss's law – Maxwell's first law (div(D)= ρ v), Laplace's and Poison's equations and solution of Laplace's equation in one variable.

UNIT II

Conductors – Dielectrics and Capacitance:

Electric dipole – dipole moment – potential and EFI due to an electric dipole, Torque on an Electric dipole in an electric field, conductors and Insulators – their behavior in electric field. Polarization, boundary conditions between conductor to dielectric, dielectric to dielectric and conductor to free space. Capacitance of parallel plates, spherical dielectrics, energy stored and energy density in a static electric field, current density, conduction and convection current densities, Ohm's law in point form – equation of continuity.

UNIT III

Magneto statics, Ampere's Law and Force in magnetic fields:

Biot-Savart's law and its applications viz. Straight current carrying filament, circular, square, rectangle and solenoid current carrying wire – Maxwell's second Equation (div(B)=0), Ampere's circuital law and its applications viz. MFI due to an infinite sheet, long filament, solenoid, toroidal current carrying conductor, point form of Ampere's circuital law, Maxwell's third equation (Curl (H)=J) Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors.

UNIT IV

Self and mutual inductance:

Self and mutual inductance – determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and density in a magnetic field.

UNIT V

Time Varying Fields:

Faraday's laws of electromagnetic induction – integral and point forms, Maxwell's fourth equation (Curl(E)=- $\partial B/\partial t$), statically and dynamically induced EMF – modification of Maxwell's equations for time varying fields, displacement current, Poynting theorem and Poynting vector.

TEXT BOOKS:

1. "Engineering Electromagnetics" by William H. Hayt & John. A. Buck Mc. Graw-Hill, 7 th Editon.2006.

2. "Principles of Electro Magnetics" by Sadiku, Oxford Publications, 6th edition, 2015.

REFERENCE BOOKS:

1. Introduction to Electro Dynamics by D J Griffiths, Prentice-Hall of India Pvt. Ltd, 2 nd edition

2. Electromagnetic Field Theory by Yaduvir Singh, Pearson India, 1st edition, 2011.

3. Fundamentals of Engineering Electromagnetics by Sunil Bhooshan, Oxford University Press,2012. 4. Electromagnetics by Joseph A. Edminister, Schaum's Outline,4th Edition,2014.

ELECTRICAL CIRCUITS LAB

Lecture – Tutorial:	3-0 Hours	Internal Marks:	35						
Credits:	lits: 1.5 External Marks: 50								
Course Objectives:									
> To verify and demonstrate various theorems and resonance.									
> To draw the locus diagram of series circuits									
> To determine the various parameters of a two port networks									

- To determine self and mutual inductance of a magnetic circuit, parameters of a given coil.
- > To measure the power of three phase unbalanced circuit.

List of Experiments

(Any 10 of the following experiments are to be conducted)

- 1. Verification of Kirchhoff's circuit laws.
- 2. Verification of Superposition theorem
- 3. Verification of Thevenin's and Norton's Theorems
- 4. Verification of Maximum power transfer theorem
- 5. Verification of Compensation theorem
- 6. Verification of Reciprocity and Millman's Theorems
- 7. Locus diagrams of R-L(L Variable) and R-C (C Variable) series circuits
- 8. Series and parallel resonance
- 9. Determination of self, mutual inductances and coefficient of coupling

10. Determination of Impedance (Z) and Admittance (Y) Parameters for a two port network

- 11. Determination of Transmission and Hybrid parameters
- 12. Determination of Parameters of a choke coil.
- 13. Determination of cold and hot resistance of an electric lamp.

14. Measurement of 3-phase power by two wattmeter method for unbalanced loads

DC MACHINES AND TRANSFORMERS LAB

Lecture – Tutorial:	3-0 Hours	Internal Marks:	35
Credits:	1.5	External Marks:	50
Course Objectives			

> To plot the magnetizing characteristics of DC shunt generator and understand the mechanism of self-excitation.

➢ To control the speed of DC motors.

- > To determine and predetermine the performance of DC machines.
- > To predetermine the efficiency and regulation of transformers and assess their performance.

List of Experiments

(Any 10 of the following experiments are to be conducted)

1. Determination of critical field resistance and critical speed of DC shunt generator by using Magnetization characteristics

2. Predetermination of efficiency of DC Machine by conducting Swinburne's test

3. Performance characteristics of a DC shunt motor by conducting Brake test.

4. Predetermination of efficiency of two DC shunt machines by conducting Hopkinson's test

5. Speed control of DC shunt motor by Field and armature Control methods

6. Determination of constant losses of DC shunt motor by conducting Retardation test

7. Separation of losses (Eddy current and Hysteresis) in a DC shunt motor.

8. Predetermination of efficiency, regulation and to obtain the parameters of the equivalent circuit of a single phase transformer by conducting OC & SC tests.

9. Predetermination of efficiency, regulation and to obtain the parameters of the equivalent circuit of a single phase transformer by conducting Sumpner's test.

10. Conversion of three phase to two phase supply by using Scott connection of transformers

11. Parallel operation of two Single phase Transformers under no-load and load conditions

12. Separation of core losses of a single phase transformer

13. Heat run test on a bank of three single phase Delta connected transformers

ELECTRONIC DEVICES AND CIRCUITS LAB

Lecture – Tutorial:	3-0 Hours	Internal Marks:	35	
Credits:	1.5	External Marks:	50	
Course Objectives:				
To study the cha instruments	racteristics of	of electronic components and	measuring	
\sim To understand the	characteristic	as of PN Zener diode design re	otifiers with	
and without filters	characteristic	es of TN, Zener uloue, design re	cullers with	
To understand the	characteristic	s of BJT, FET, MOSFET, SCR, U	JT	
To understand the	biasing of tra	nsistors		
➢ To understand the	frequency r	esponse of amplifiers, measure	frequency,	
phase of signals.				

Electronic Workshop Practice:

1. Identification, Specifications, Color Codes for resistor, R, L, C Components, Potentiometers, Coils, Gang condensers, Relays, Bread Boards.

2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT. 3. Soldering Practice- Simple circuits using active and passive components.

4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital

5. Multimeter, Function Generator, Regulated Power Supply and CRO.

List of Experiments

(Any 10 of the following experiments are to be conducted)

1. P.N Junction Diode Characteristics

Part A: Germanium Diode (Forward bias& Reverse bias)

Part B: Silicon Diode (Forward Bias only)

.Zener Diode Characteristics

Part A: V-I Characteristic

Part B: Zener Diode as Voltage Regulator

3.Rectifiers (without and with c-filter)

Part A: Half-wave Rectifier

Part B : Full-wave Rectifier

4.BJT Characteristics (CE Configuration)

Part A: Input Characteristics

Part B: output Characteristics

5.FET Characteristics

Part A: Drain Characteristics

Part B: Transfer Characteristics

6.SCR Characteristics

7.UJT Characteristics

8.MOSFET Characteristics

9.Transistor Biasing

10. Measurement of electrical quantities using CRO

11. BJT-CE Amplifier

12.Emitter Follower –CC Amplifier

13.FET-CS Amplifier

Equipment required:

1.Regulated Power supplies

- 2.Analog/Digital Storage Oscilloscopes
- 3.Analog/Digital Function Generators
- 4.Digital Multi-meters 5.Decade Résistance Boxes/Rheostats
- 6.Decade Capacitance Boxes

7.Ammeters (Analog or Digital)

- 8. Voltmeters (Analog or Digital)
- 9. Active & Passive Electronic Components

SKILL ORIENTED COURSE

DESIGN OF ELECTRICAL CIRCUITS USING ENGINEERING SOFTWARE

TOOLS

Lecture – Tutorial:	3-0 Hours	Internal Marks:	-							
Credits:2External Marks:50										
Course Objectives:										
To Learn the fundamentals of MATLAB Tools										
To generate various waveform signals and sequences										

- > To verify and simulate various electrical circuits using Mesh and Nodal Analysis
- To verify and simulate various theorems
- To verify and simulate RLC series and parallel resonance.
- > To determine self and mutual inductance of a magnetic circuit, parameters of a given coil.

List of Experiments

(Any 10 of the following experiments are to be conducted)

Note: MATLAB/SMULINK fundamentals shall be explained during the first week before starting of the Lab course

1. Generation of various signals and sequences (Periodic and Aperiodic), such as unit Impulse, Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp.

2. Operations on signals and sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy, and Average Power.

3. Verification of Kirchhoff's current law and voltage law using simulation tools.

4. Verification of mesh analysis using simulation tools.

5. Verification of nodal analysis using simulation tools.

6. Determination of average value, rms value, form factor, peak factor of sinusoidal wave, square wave using simulation tools.

7. Verification of super position theorem using simulation tools.

8. Verification of reciprocity theorem using simulation tools.

9. Verification of maximum power transfer theorem using simulation tools.

10. Verification of Thevenin's theorem using simulation tools.

11. Verification of Norton's theorem using simulation tools.

12. Verification of compensation theorem using simulation tools.

13. Verification of Milliman's theorem using simulation tools.

14. Verification of series resonance using simulation tools.

15. Verification of parallel resonance using simulation tools.

16. Verification of self inductance and mutual inductance by using simulation tools.

PROFESSIONAL ETHICS & HUMAN VALUES

Lect	ture – Tutorial: 2-0 Hours Internal Marks: 30												
Cred	dits: 0 External Marks: 70												
Course Objectives:													
Þ	To create an awareness on Engineering Ethics and Human Values.												
\succ	To instill Moral and Social Values and Loyalty												
\succ	To appreciate the rights of others												
\succ	To create awareness on assessment of safety and risk												
Course Outcomes													
Upon successful completion of the course, the student will be able													
to:													
CO1	Identif	y and a	nalyze ar	n ethica	al issu	le in	the su	bject r	natter	under	r inve	stigat	ion or
	in a relevant field												
CO2	D2 Identify the multiple ethical interests at stake in a real-world situation or practice												
CO3	O3 Articulate what makes a particular course of action ethically defensible												
CO4	Assess	s their ov	vn ethica	d values	s and	the s	ocial c	ontext	of prot	olems			
CO5	Identif	y ethica	l concerr	ns in re	searc	h and	intelle	ectual	context	ts, inc	cludin	g aca	demic
	integri	ty, use	and citat	tion of	sourc	es, th	ie obje	ctive p	resent	ation	of da	ta, ar	nd the
	treatm	lent of h	uman su	bjects									
C06	Demoi	nstrate]	knowledg	ge of e	thical	valu	es in	non-cl	assroo	m ac	tivitie	s, su	ch as
0	service	e learnin	g, intern	ships, a	and fi	eld wo	ork			Dur		<u> </u>	
(1 - L)	ow, 2-M	edium, 3	ourse O 3 – High)	utcome	s to	waras	асп	leveme	ητ οι	PIO	gram	Out	comes
	,	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	01	1	2	3	4	5	6	7	8	9	10	11	12
									. <u></u>				
C	02	3	1										I
C	04	3	1										·
C	05	3	1										
С	06	3	1										

UNIT I

Human Values:

Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others –Living Peacefully –Caring –Sharing –Honesty -Courage-Cooperation– Commitment – Empathy –Self Confidence Character –Spirituality. Learning outcomes:

- 1. Learn about morals, values & work ethics.
- 2. Learn to respect others and develop civic virtue.
- 3. Develop commitment
- 4. Learn how to live peacefully

UNIT II

Engineering Ethics:

Senses of 'Engineering Ethics-Variety of moral issued –Types of inquiry –Moral

dilemmas – Moral autonomy –Kohlberg's theory-Gilligan's Theory-Consensus and controversy –Models of professional roles-Theories about right action-Self-interest -Customs and religion –Uses of Ethical theories –Valuing time –Cooperation – Commitment. Learning outcomes:

- 1. Learn about the ethical responsibilities of the engineers.
- 2. Create awareness about the customs and religions.
- 3. Learn time management
- 4. Learn about the different professional roles.

UNIT III

Engineering as Social Experimentation:

Engineering As Social Experimentation –Framing the problem –Determining the facts – Codes of Ethics –Clarifying Concepts –Application issues –Common Ground - General Principles –Utilitarian thinking respect for persons. Learning outcomes: 1. Demonstrate knowledge to become a social experimenter. 2. Provide depth knowledge on framing of the problem and determining the facts. 3. Provide depth knowledge on codes of ethics. 4. Develop utilitarian thinking

UNIT IV

Engineers Responsibility for Safety and Risk:

Safety and risk –Assessment of safety and risk –Risk benefit analysis and reducing risk- Safety and the Engineer-Designing for the safety-Intellectual Property rights (IPR).

Learning outcomes:

1. Create awareness about safety, risk & risk benefit analysis. 2. Engineer's design practices for providing safety.

3. Provide knowledge on intellectual property rights.

UNIT V

Global Issues:

Globalization –Cross-culture issues-Environmental Ethics –Computer Ethics – Computers as the instrument of Unethical behavior –Computers as the object of Unethical acts – Autonomous Computers-Computer codes of Ethics –Weapons Development -Ethics and Research –Analyzing Ethical Problems in research. Learning outcomes:

1. Develop knowledge about global issues.

- 2. Create awareness on computer and environmental ethics
- 3. Analyze ethical problems in research.
- 4. Give a picture on weapons development.

TEXT BOOKS:

1) "Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and, V.S.Senthil Kumar-PHI Learning Pvt. Ltd-2009

2) "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

3) "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger –Tata McGraw-Hill–2003.

4) "Professional Ethics and Morals" by Prof.A.R.Aryasri, DharanikotaSuyodhana-

Maruthi Publications.

5) "Professional Ethics and Human Values" by A.Alavudeen, R.KalilRahman and M. Jayakumaran, Laxmi Publications.

6) "Professional Ethics and Human Values" by Prof.D.R.Kiran-"Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication

PYTHON PROGRAMMING

Lecture	ure – Tutorial: 3-1 Hours Internal Marks: 30											
Credits	ts: 3 External Marks: 70											
Course Objectives:												
> To	> To learn about Python programming language syntax, semantics, and the											
rı	runtime environment											
> T	> To be familiarized with universal computer programming concepts like data											
ty	types, containers											
r <	> To be familiarized with general computer programming concepts like											
С	conditional execution, loops & functions											
> T	o be familia	rized w	ith ge	enera	1 cod	ling t	echnic	ques a	and	objec	ct-ori	ented
p	rogramming											
Course	e Outcomes											
Upon	successful	comp	letior	ı of	the	cours	se, th	e stu	den	t wi	11 be	:
able t	: o:											
CO1	Develop esser	ntial pro	gramm	ing s	kills i	n com	puter	progra	mmiı	ng co	ncept	s like
	data types											
CO2	Develop esser	ntial pro	gramm	ing s	kills i	n com	puter	progra	mmiı	ng co	ncept	s like
	containers											
CO3	Apply the bas	ics of pro	gramn	ning in	n the	Pythor	ı langu	age				
CO4	Solve coding t	asks rela	ited con	nditio	nal ex	ecutio	n					
CO5	Solve coding t	asks rela	ited loc	ps								
CO6	Solve coding	tasks rel	ated to	o the	funda	amenta	al notic	ons an	d tec	hniqu	les us	sed in
0 1 1	object- oriente	ed progra	imming	<u>g</u>							<u> </u>	
(1 – Low	ution of Co v. 2- Medium. 3	urse Ou 3 – High)	itcome	s to	wards	achi	evemer	it of	Prog	gram	Outo	comes
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	РО
	1	2	3	4	5	6	7	8	9	10	11	12
CO												
CO	4 3	3										
CO	5 3	3										
CO	CO6 3 3 .											

UNIT I

Introduction:

Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.

Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

UNIT II

Control Statement: Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration The While Loop Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.

UNIT III

List and Dictionaries:

Lists, Defining Simple Functions, Dictionaries Design with Function: Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System, Managing a Program's Namespace, Higher Order Function. Modules: Modules, Standard Modules, Packages.

UNIT IV

File Operations:

Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance, overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using OOPs support Design with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism

UNIT V

Errors and Exceptions:

Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions. Graphical User Interfaces: The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources. Programming: Introduction to Programming Concepts with Scratch.

TEXT BOOKS:

1) Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage, 2/e, 2011.

REFERENCE BOOKS:

1) Introduction to Python Programming, Gowrishankar S., VeenaA, CRC Press, 2nd Edition, 2019.

2) Introduction to Programming Using Python, Y. Daniel Liang, Pearson, 1st Edition, 2012.

E-RESOURCES:

1) https://www.tutorialspoint.com/python3/python_tutorial.pdf
DIGITAL ELECTRONICS

Lectu	re – Tu	torial:	3	-1 Ho	urs]	ntern	al Ma	rks:		30	
Credit	ts:		3	}			I	Extern	al Ma	rks:		70	
Cours	e Objec	tives:				•							
\triangleright	To solv	e a typi	ical nui	mber l	oase	conv	ersion	and	analyz	æ ne	w er	ror co	oding
	techniq	ues.											
	Theorer	ns and :	function	ns of B	oolea	n alg	gebra a	and be	havior	of lo	ogic g	ates.	
\succ	To optimize logic gates for digital circuits using various techniques.												
\succ	To understand concepts of combinational circuits.												
\triangleright	To develop advanced sequential circuits.												
Cour	'se Outcomes												
Upor	n successful completion of the course, the student will be												
able	to:		- -										
CO1	Classi	fy differe	ent num	ber sys	tems	and a	pply to	o gener	ate va	rious	codes	3.	
CO2	Ilse th		nt of Boo	lean al	loehra	in m	inimiz	ation o	fewitch	ning f	unctio	nne	
CO3	Design	n differer	nt types	of com	hinati	onall	logic ci	rcuits	10 11 11 11	11115 1	unen	5110	
CO4	Apply	knowled	ge of flir	of com	in des	signin	g of Re	egisters	3				
CO5	Apply	knowled	ge of flir	p-flops	in des	signin	g of co	unters					
C06	The or	neration	and des	sign m	ethod	nlogy	for sv	nchror	0118 86	niien	tial c	ircuit	and
	algorit	thmic sta	ate mach	nines.	etiiou	01055	101 Oy	110111 01	040 00	quen	uur c	neuro	Juna
Contr	ibution	of Cou	urse Ou	itcome	s to	wards	achi	evemei	nt of	Pro	gram	Outo	omes
(1 – Le	ow, 2- M	edium, 3	– High)	1		1		1					
		PO 1	PO 2	PO 2	PO	PO	PO	PO 7	PO	PO	PO 10	PO 11	PO
С	01	3	1	3		3	0	-	0	9	10	11	14
C	02	3											
С	03	3											
С	04	3											
С	05	3	1										
C	06	3	1										

UNIT I

Review of Number Systems & Codes:

Representation of numbers of different radix, conversion from one radix to another radix, r- 1's complements and r's complements of signed members. Gray code,4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc., Error detection & correction codes: parity checking, even parity, odd parity, Hamming code.

Boolean theorems and logic operations

Boolean theorems, principle of complementation & duality, De-Morgan theorems. Logic operations; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX-NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations.

UNIT II

Minimization Techniques:

Minimization and realization of switching functions using Boolean theorems, K-Map

(up to 6 variables) and tabular method.

Combinational Logic Circuits Design:

Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders; 4- bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a-head adder circuit

UNIT III

Combinational Logic Circuits

Design Using MSI &LSI: Design of encoder, decoder, multiplexer and demultiplexers, Implementation of higher order circuits using lower order circuits. Realization of Boolean functions using decoders and multiplexers. Design of Priority encoder, 4-bit digital comparator and seven segment decoder

Introduction of PLD's:

PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions.

UNIT IV

Sequential Circuits-I:

Classification of sequential circuits (synchronous and asynchronous), operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flipflop, JK flip- flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip-flop. Design of ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.

UNIT V

Sequential Circuits -II:

Finite state machine; state diagrams, state tables, reduction of state tables. Analysis of clocked sequential circuits Mealy to Moore conversion and vice-versa. Realization of sequence generator and sequence detector circuits, Races and Hazards.

TEXT BOOKS:

1. Switching and finite automata theory:ZviKohavi, Niraj K. Jha,Cambridge University Press, 3rd Edition, 2009.

2. Digital Design by Morris Mano, Prentice Hall India, 5th Edition.

REFERENCE BOOKS:

1. Digital Principles and Applications by Leach, Malvino, Saha, Mc-Graw Hill, 8th Edition, 2014.

2. Switching Theory and Logic Design by A. Anand Kumar, PHI learning, 3rd edition.

3. Introduction to Switching Theory and Logic Design – Fredriac J Hill, Gerald R Peterson, 3rdEdition, John Willey and Sons Inc,

4. Fundamentals of Logic Design by Charles H. RothJr., Cengage Learning, 7th edition, 2013.

POWER SYSTEMS-I

Lectu	re – Tu	torial:	3	-1 Hou	ırs		Ir	nterna	l Mar	ks:		30		
Credi	ts:		3				E	xterna	al Mar	ks:		70		
Cours	se Objec	tives:												
\triangleright	To stuc	ly the p	principle	e of op	peratio	on o	f diffe	erent o	compo	nent	s of	a the	ermal	
	power stations.													
\succ	To study the principle of operation of different components of a Nuclear													
	power stations.													
\succ	 To study the constructional and operation of different components of an Air 													
	and Gas Insulated substations.													
\triangleright	To study the constructional details of different types of cables.													
\succ	To stuc	ly differ	ent type	es of lo	ad cu	rves	and t	ariffs	applica	able	to coi	nsum	ers.	
Cour	se Outo	comes												
Upo	n succ	essful	comp	letior	n of t	he	cours	se, th	e stu	den	t wi	ll be		
able	to:													
CO1	Identi	fy the dif	fferent co	ompone	ents of	ther	mal po	ower pl	ants.					
CO2	Identi	fy the dif	ferent co	ompone	ents of	nuc	lear Po	wer pl	ants.					
CO3	Identi	fy the dif	fferent co	ompone	ents of	air i	nsulat	ed sub	station	lS.				
CO4	Identi	fy the dif	fferent co	ompone	ents of	gas	insulat	ted sul	ostatio	ns.				
CO5	Identi	fy single	core and	1 three	core ca	ables	s with o	differe	nt insu	lating	g mate	erials.		
CO6	Analys	se the di	fferent e	conomi	ic facto	rs of	power	gener	ation a	nd ta	riffs.			
							<u> </u>							
(1 - L)	ow. 2- M	oi Cou edium. 3	irse Ot – High)	Itcomes	s tow	aras	achie	evemei	IT OI	Prog	gram	Outo	omes	
	- / -	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	
	NO1	1	2	3	4	5	6	7	8	9	10	11	12	
	201 202	3	2											
	:03	3												
C	:04	3												
C	:05	3	2											
C	:06	3	2											

UNIT I

Hydroelectric Power Stations: Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation **Thermal Power Stations** Selection of site, general layout of a thermal power plant. Brief description of components: boilers, super heaters, economizers and electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney.

UNIT II

Nuclear Power Stations

Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactors and brief description of PWR, BWR

and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal.

UNIT III

Classification of Air and Gas Insulated substations

Air Insulated Substations – indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment. Bus bar arrangements in the sub-stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.

Gas Insulated Substations (GIS) – advantages of gas insulated substations, constructional aspects of GIS, installation and maintenance of GIS, comparison of air insulated substations and gas insulated substations.

UNIT IV

Underground Cables

Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable. Capacitance of single and 3-Core belted Cables. Grading of cables: capacitance grading and intersheath grading.

UNIT V

Economic Aspects of Power Generation & Tariff

Economic Aspects – load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor and plant use factor, base and peak load plants.

Tariff Methods– costs of generation and their division into fixed, semi-fixed and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block- rate, two-part, three–part, and power factor tariff methods.

TEXT BOOKS:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagarand A. Chakrabarti, DhanpatRai& Co. Pvt. Ltd, 2016.

2. Generation, Distribution and Utilization of Electric Energy by C.L.Wadhawa, New age International (P) Limited, Publishers, 3rd edition.

REFERENCE BOOKS:

1. Elements of Electrical Power Station Design by M V Deshpande, PHI, New Delhi, 2009.

INDUCTION AND SYNCHRONOUS MACHINES

Lecture – Tu	torial:	3	-1 Hou	rs		In	terna	1 Marl	ks:		30			
Credits:		3				Ez	terna	1 Mar	ks:		70			
Course Obje	ctives:													
 Unders inducti 	tand th	e prir	nciple	of op	erati	ion a	and p	perform	nanc	e of	3-r	ohase		
Quanti	fy the pe	erforma	ance of	indu	ction	mot	or an	d ind	actio	n gei	nerat	or in		
terms o	of torque	and sli	ip.											
To und motor.	To understand the torque producing mechanism of a single phase induction motor.													
≻ To un	To understand the principle of emf generation, the effect of armature													
reaction	reaction and predetermination of voltage regulation in synchronous													
generat	generators.													
> To stu	dy paral	lel ope	eration	and o	contr	ol of	real	and 1	react	ive p	ower	's for		
synchr	onous ge	nerato	rs.											
≻ To un	derstand	the	operati	on, p	berfo	rman	.ce ar	nd sta	artin	g m	ethod	ls of		
synchro	onous mo	otors.												
Course Out	comes													
Upon succ	essful (comp	letion	of th	he c	ours	e, th	e stu	den	t wi	ll be	•		
able to:														
CO1 Expla	in the ope	eration	and peri	formar	nce of	three	e phase	e induc	tion	motoi				
CO2 Analy genera	ze the tore ator	que-spe	eed relat	tion, po	erforr	nance	e of ind	luction	mote	or and	d indı	action		
CO3 Imple	ment the	starting	g ofsingl	e phas	se ind	uction	n moto	rs.						
CO4 Develo	op windi ators.	ng des	sign ar	nd pro	edete	rmine	e the	regula	ation	ofsy	nchro	onous		
CO5 Expla	in huntin	ng pher	nomenor	n of s	taring	g and	l corre	ction	of po	wer	factor	with		
synch	ronous m	otor.							-					
CO6 Expla	in impler	nent m	nethods	of sta	arıng	and	correc	ction o	ot po	wer i	actor	with		
Contribution	of Cou	rse Ou	itcomes	towa	ards	achie	evemen	t of	Prog	gram	Outo	comes		
(1 – Low, 2- M	edium, 3 -	- High)												
	PO 1	PO 2	PO 3		PO 5	PO 6	PO 7	PO	PO	PO 10	PO 11	PO 12		
CO1	3	2	5		5	0		0	,	10		14		
CO2	2	3												
CO3	3	3												
C04	2	3												
C05	3	3	$\left \right $											
	Ū	0												

UNIT I

3-phase induction motors

Construction details of squirrel cage and slip ring induction motors – production of rotating magnetic field – principle of operation – Equivalent circuit –phasor diagram- slip speed-rotor emf and rotor frequency – rotor current and pf at

standstill and during running conditions – rotor power input, rotor copper loss and mechanical power developed and their interrelationship.

UNIT II

Characteristics and testing methods of induction motors

Torque equation – expressions for maximum torque and starting torque – torque slip characteristic – double cage and deep bar rotors – crawling and cogging – speed control of induction motor with V/f control method – no load and blocked rotor tests – circle diagram for predetermination of performance – induction generator operation (Qualitative treatment only)

UNIT III

Starting methods of 3-phase induction motors

Methods of starting of three phase Induction motors: DOL, Auto transformer, Star-Delta and rotor resistance methods.

Single phase induction motors: Constructional features- equivalent circuitproblem of starting-double revolving field theory- Methods of starting. AC series motors.

UNIT IV

Construction, operation, voltage regulation and parallel operation of synchronous generator:

Constructional features of non-salient and salient pole machines –types of armature windings – distribution, pitch and winding factors – E.M.F equation – improvements of waveform and armature reaction –phasor diagrams- voltage regulation by synchronous impedance method – MMF method and Potier triangle method– two reaction analysis of salient pole machines and phasor diagram. Parallel operation with infinite bus and other alternators – synchronizing power – load sharing – control of real and reactive power – numerical problems.

UNIT V

Synchronous motor – operation, starting and performance

Synchronous motor principle and theory of operation – phasor diagram – starting torque – variation of current and power factor with excitation – capability curves - synchronous condenser – mathematical analysis for power developed – hunting and its suppression – methods of starting – applications.

TEXT BOOKS:

1. Electrical Machines by P.S. Bhimbra, Khanna Publishers

2. Electric Machinery by A.E.Fitzgerald, Charles Kingsley, Stephen D.Umans, TMH

REFERENCE BOOKS:

1. 1.Performance and design of AC machines - M.G. Say

2. Alternating Current Machines by A.F.Puchstein, T.C. Lloyd, A.G. Conrad, ASIA Publishing House 3. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education, 2010.

4. Electrical Machines by R.K.Rajput, Lakshmi publications, 5th edition

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Introd	uction	to Man	ageria	l Econ	J omio	JNIT	I			•			

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

UNIT II

Theories of Production and Cost Analyses:

Theories of Production function- Law of Variable Proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale- Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit Analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

UNIT III

Introduction to Markets, Theories of the Firm & Pricing Policies:

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles: Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

UNIT IV

Introduction to Accounting & Financing Analysis:

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

UNIT V

Capital and Capital Budgeting:

Capital Budgeting: Meaning of Capital-Capitalization- Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (payback period, accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

TEXT BOOKS:

1. Managerial Economics and Financial Analysis by A R Aryasri, McGraw – Hill, 3rd edition.

REFERENCE BOOKS:

1. Managerial Economics by Varshney R.L, K.L Maheswari, S. Chand & Company Ltd,

2. Managerial Economics, JL Pappas and EF Brigham, Holt, R & W; New edition.

3. Accounting for Management, N.P Srinivasn and M. Sakthivel Murugan, S. Chand & Company Ltd, 1 st edition, 2011.

4. An Introduction to Accountancy by Maheswari S.N, Vikas Publishing House Pvt Ltd, 12th edition, 2018.

5. Financial Management by I.M Pandey, Vikas Publishing House Pvt Ltd, 9th edition, 2009.

6. Managerial Economics by V. Maheswari, S. Chand & Company Ltd, 2002.

PYTHON PROGRAMMING LAB

Lecture – Tutorial:	3-0 Hours	Internal Marks:	35								
Credits:	1.5	External Marks:	50								
Course Objectives:											
To acquire program	ming skills in	core Python.									
To acquire Object O	riented Skills	s in Python									
To develop the skill	> To develop the skill of designing Graphical user Interfaces in Python										
To develop the ability to write database applications in Python											

List of Experiments

1) Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.

2) Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.

3) Write a program that uses a for loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86,89.

4) Writeaprogramthataskstheuserfortheirnameandhowmanytimestoprintit.The program should print out the user's name the specified number of times.

5) Use a for loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.

* ** *** ***

6) Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.

7) Write a program that asks the user for two numbers and prints Close if the numbers are within .001 of each other and Not close otherwise.

8) Write a program that asks the user to enter a word and prints out whether that word contains any vowels.

9) Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters abcde and ABCDE the program should print outAaBbCcDdEe.

10) Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large

numbers. For instance, if the user enters 1000000, the output should be1,000,000.

11) In algebraic expressions, the symbol for multiplication is often left out, as in 3x+4y or 3(x+5). Computers prefer those expressions to include the multiplication symbol, like 3*x+4*y or 3*(x+5). Write a program that asks the user for an algebraic expression and then inserts multiplication symbols where appropriate.

12) Write a program that generates a list of 20 random numbers between 1 and 100. (a) Print the list. (b) Print the average of the elements in the list. (c) Print the largest and smallest values in the list. (d) Print the second largest and second smallest entries in the list (e) Print how many even numbers are in the list.

13) Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.

14) Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in [1,0,1,1,0,0,0,0,1,0,0] is4.

15) Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become[1,2,3,4,0].

16) Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements, itis much shorter with lists and it is also easier to add new conversions if you use lists.

17) Write a function called sum_digits that is given an integer num and returns the sum of the digits of num.

18) Write a function called first_diff that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return-1.

19) Write a function called number_of_factors that takes an integer and returns how many factors the number has.

20) Write a function called is_sorted that is given a list and returns True if the list is sorted and False otherwise.

21) Write a function called root that is given a number x and an integer n and returns x1/n. In the function definition, set the default value of n to2.

22) Write a function called primes that is given a number n and returns a list of the first n primes. Let the default value of n be100.

23) Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list. (a) Do this using the sort method. (b) Do this without using the sort method.

24)Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word. 25) Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.

26) Write a program that reads a list of temperatures from a file called temps.txt, converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt.

27) Write a class called Product. The class should have fields called name, amount, and holding the product's name, the number of items of that product in stock, and the regular price of the product. There should be a method get_price that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called make_purchase that receives the number of items to be bought and decreases amount by that much.

28) Write a class called Time whose only field is a time in seconds. It should have a method called convert_to_minutes that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called convert_to_hours that returns a string of hours, minutes, and seconds formatted analogously to the previous method.

29) Write a class called Converter. The user will pass a length and a unit when declaring an object from the class for example, c = Converter(9, 'inches'). The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call c. feet() and should get 0.75 as the result.

30) Write a Python class to implement pow(x,n).

31) Write a Python class to reverse a string word byword.

32) Write a program that opens a file dialog that allows you to select a text file. The program then displays the contents of the file in a textbox.

33) Write a program to demonstrate Try/except/else.

34) Write a program to demonstrate try/finally and with/as

INDUCTION AND SYNCHRONOUS MACHINES LAB

Lecture – Tutorial:	3-0 Hours	Internal Marks:	35
Credits:	1.5	External Marks:	50
Common Ohiostimos			

Course Objectives:

- > Speed control methods of three-phase induction motors.
- Performance characteristics of three-phase and single-phase induction motors.
- > Principles of power factor improvement of single-phase induction motor.
- Voltage regulation calculations of three-phase alternator by various methods,
- > Performance curves of three-phase synchronous motor.

List of Experiments

(Any 10 of the following experiments are to be conducted)

1. Performance characteristics of a three- phase Induction Motor by conducting Brake test

2. Determination of equivalent circuit parameters, efficiency and regulation of a three phase Induction motor by conducting No–load & Blocked rotor tests

3. Determination of Regulation of a three–phase alternator by using synchronous impedance & m.m.f. methods

4. Determination of Regulation of a three–phase alternator by using Potier triangle method

5. Determination of V and Inverted V curves of a three phase synchronous motor.

6. Determination of Xd and Xq of a salient pole synchronous machine

7. Speed control of three phase induction motor by V/f method.

8. Determination of equivalent circuit parameters of single phase induction motor

9. Determination of efficiency of three-phase alternator by loading with three phase induction motor.

10. Power factor improvement of single-phase induction motor by using capacitors.

11. Parallel operation of three-phase alternator under no-load and load conditions

12. Determination of efficiency of a single-phase AC series Motor by conducting Brake test.

13. Starting of single-phase Induction motor by using capacitor start and capacitor start run methods.

14. Determination of efficiency of a single-phase Induction Motor by conducting Brake test.

DIGITAL ELECTRONICS LAB

Lecture – Tutorial:	3-0 Hours	Internal Marks:	35								
Credits:	1.5	External Marks:	50								
Course Objectives:	ourse Objectives:										
To know the con	cept of Boolean I	aws for simplifying the digital cir	cuits.								
To understand t	the concepts of f	ipflops.									
To understand t	To understand the concepts of counters.										
To analyze and	To analyze and design various circuits.										

List of Experiments

(Any 10 of the following experiments are to be conducted)

1. Verification of truth tables of Logic gates: Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive OR (vi) Exclusive NOR

2. Design a simple combinational circuit and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit

3. Verification of functional table of 3 to 8 line Decoder / De-multiplexer

4. 4 variable logic function verification using 8 to 1 multiplexer.

5. Design full adder circuit and verify its functional table.

6. Design full Subtractor circuit and verify its functional table.

7. Verification of functional tables of Flip-Flops

8. Design a four bit ring counter using D Flip – Flops / JK Flip Flop and verify output

9. Design a four bit Johnson's counter using D Flip-Flops / JK Flip Flops and verify output

10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T- Flip-Flops and Test it with a low frequency clock and Sketch the output waveforms.

11. Design MOD – 10 ripple counter using T- Flip-Flop and verify the result and Sketch the output waveforms

12. Design MOD – 8 synchronous counter using D Flip-Flop and verify the result and Sketch the output waveforms.

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CO2	Detern	nine the	e perforn	nance o	f short,	medium	and lo	ng transi	mission	lines.		
CO3	Analys	e the ef	fect of ti	ravellin	g waves	on trans	smissior	n lines.				
CO4	Analys	e the va	rious vo	ltage co	ontrol m	ethods a	and effe	ect of co	rona.			
CO5	Calcula	ite sag o	of transn	nission l	lines and	d perfor	mance o	of line in	sulators			
CO6	Calcula	ite tensi	ion of tra	ansmiss	ion line	s and pe	rformar	nce of lir	ne insula	tors.		
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CO4 CO5	3	2	1					1	2			

UNIT I

Transmission Line Parameters Conductor materials – Types of conductors – Calculation of resistance for solid conductors – Skin and Proximity effects – Calculation of inductance for Single-phase and Three-phase– Single and double circuit lines– Concept of GMR and GMD–Symmetrical and asymmetrical conductor configuration with and without transposition–Bundled conductors – Calculation of capacitance for 2 wire and 3 wire systems – Effect of ground on capacitance – Capacitance calculations for symmetrical and asymmetrical single and Three-phase–Single and double circuit lines without and with Bundled conductors.

UNIT II

Performance Analysis of Transmission Lines Classification of Transmission Lines – Short, medium, long lines and their model representation – Nominal-T, Nominal-Pie and A, B, C, D Constants for symmetrical and Asymmetrical Networks. Rigorous Solution for long line equations –Representation of Long lines – Equivalent T and Equivalent Pie network models - Surge Impedance and Surge Impedance Loading (SIL) of Long Lines - Regulation and efficiency for all types of lines – Ferranti effect.

UNIT III

Power System Transients Types of System Transients – Propagation of Surges – Attenuation–Distortion– Reflection and Refraction Coefficients.

Termination of lines with different types of conditions – Open Circuited Line–Short Circuited Line – TJunction – Lumped Reactive Junctions.

UNIT IV

Corona Description of the phenomenon – Types of Corona - critical voltages and power loss – Advantages and Disadvantages of Corona - Factors affecting corona - Radio Interference.

UNIT V

Sag and Tension Calculations and Overhead Line Insulators: Sag and Tension calculations with equal and unequal heights of towers–Effect of Wind and Ice on weight of Conductor – Stringing chart and sag template and its applications Types of Insulators – String efficiency and Methods for improvement - Voltage distribution–Calculation of string efficiency – Capacitance grading and Static Shielding.

TEXT BOOKS:

Electrical Power Systems – by C.L.Wadhwa, New Age International (P) Limited, 1998.
 Power System Engineering by I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 3 rd Edition.

REFERENCE BOOKS:

1. Power system Analysis-by John J Grainger William D Stevenson, TMC Companies, 4th edition

2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.

3. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar A.Chakrabarthy, DhanpatRai Co Pvt. Ltd.2016

4. Electrical Power Systems by P.S.R. Murthy, B.S. Publications, 2017.

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Lecture –	Tutor	ial:		3-1 H	lours		I	ntern	al Ma	rks:		30	
Credits:				3			E	Extern	al Ma	ırks:		70	
Course Ob	jectiv	ves:											
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➤ To 1	earn t	he ope	eratio	n of di	ifferen	it type	s of D	C-DC d	conver	ters.			
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UNIT I

Power Semi-Conductor Devices Silicon controlled rectifier (SCR) – Two transistor analogy - Static and Dynamic characteristics – Turn on and Turn off Methods -Triggering Methods (R, RC and UJT) – Snubber circuit design. Static and Dynamic Characteristics of Power MOSFET and Power IGBT– Gate Driver Circuits for Power MOSFET and IGBT - Numerical problems

UNIT II

Single-phase AC-DC Converters Single-phase half-wave controlled rectifiers - R and RL loads with and without freewheeling diode - Single-phase fully controlled mid-point and bridge converter with R load, RL load and RLE load - Continuous and Discontinuous conduction - Effect of source inductance in Single-phase fully controlled bridge rectifier – Expression for output voltages – Single-phase Semi-Converter with R load-RL load and RLE

load – Continuous and Discontinuous conduction - Harmonic Analysis – Dual converter and its mode of operation - Numerical Problems.

UNIT III

Three-phase AC-DC Converters & AC – AC Converters Three-phase half-wave Rectifier with R and RL load - Three-phase fully controlled rectifier with R and RL load - Three-phase semi converter with R and RL load - Expression for Output Voltage - Harmonic Analysis - Three-phase Dual Converters - Numerical Problems. Single-phase AC-AC power control by phase control with R and RL loads - Expression for rms output voltage – Single-phase step down and step up Cycloconverter - Numerical Problems.

UNIT IV

DC-DC Converters Operation of Basic Chopper – Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) - Output voltage equations using volt-sec balance in CCM & DCM – Expressions for output voltage ripple and inductor current ripple – control techniques – Introduction to PWM control -Numerical Problems.

UNIT V

DC-AC Converters Introduction - Single-phase half-bridge and full-bridge inverters with R and RL loads – Phase Displacement Control – PWM with bipolar voltage switching, PWM with unipolar voltage switching - Three-phase square wave inverters - 1200 conduction and 1800 conduction modes of operation - Sinusoidal Pulse Width Modulation - Current Source Inverter (CSI) - Numerical Problems.

TEXT BOOKS:

1. Power Electronics: Converters, Applications and Design by Ned Mohan, Tore M Undeland, William P Robbins, John Wiley & Sons.

2. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998

3. Power Electronics: Essentials & Applications by L.Umanand, Wiley, Pvt. Limited, India, 2009.

REFERENCE BOOKS:

1. Elements of Power Electronics-Philip T.Krein. Oxford University Press; Second edition

2. Power Electronics – by P.S.Bhimbra, Khanna Publishers.

3. Thyristorised Power Controllers - by G. K. Dubey, S. R. Doradla, A. Joshi and R.

M. K.Sinha, New Age International (P) Limited Publishers, 1996.

4. Power Electronics: by Daniel W.Hart, Mc Graw Hill.

CONTROL SYSTEMS															
Hours	Internal N	larks:	30												
	External I	Aarks:	70												
modeling of	physical systems	s and to use	block diagram												
aph to determ	ine overall transf	er function													
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performance using PI, PD, PID controllers.															
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CO3 Analyze the stability of LTI systems using frequency response methods.															
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of LTI system g-Lead compo	s using frequency	y response n ve system po	s and absolute erion and root nethods. erformance												
of LTI system g-Lead compo ystems as sta	as using frequency ensators to impro	y response n ve system pe termine the	s and absolute erion and root nethods. erformance response.												
of LTI system g-Lead compo ystems as sta epts of contro omes towar	ensators to impro te models and de pllability and obse ds achievement	y response n ve system po termine the ervability.	s and absolute erion and root nethods. erformance response. am Outcomes												
of LTI system g-Lead compo- <u>ystems as sta</u> epts of contro omes towar	as using frequency ensators to impro ate models and de pllability and obse ds achievement	y response n ve system po termine the ervability. of Progr	and absolute erion and root nethods. erformance response. am Outcomes												
of LTI system g-Lead compo- ystems as sta epts of contro omes towar	as using frequency ensators to impro- ate models and de- bilability and obsects ds achievement PO PO PO PO	y response n ve system po termine the ervability. of Progr	s and absolute erion and root nethods. erformance response. am Outcomes												
of LTI system g-Lead compo- ystems as sta epts of contro omes towar PO PO 5 6	as using frequency ensators to impro- ate models and de- pllability and obsect ds achievement PO PO PO 7 8 9	y response n ve system po termine the ervability. of Progr PO PO 10 11	s and absolute erion and root nethods. erformance response. am Outcomes PO 12												
of LTI system g-Lead compo- ystems as sta epts of contro omes towar PO PO 5 6	as using frequency ensators to impro- ate models and de- ollability and obse- ds achievement PO PO PO 7 8 9	y response n ve system po termine the ervability. of Progr PO PO 10 11	s and absolute erion and root nethods. erformance response. am Outcomes PO 12												
of LTI system g-Lead compo- ystems as sta epts of contro omes towar PO PO 5 6	as using frequency ensators to impro- ate models and de- pllability and obsect ds achievement PO PO PO 7 8 9	y response n ve system po termine the ervability. of Progr PO PO 10 11	s and absolute erion and root nethods. erformance response. am Outcomes PO 12												
of LTI system g-Lead compo- ystems as sta epts of contro omes towar PO PO 5 6	as using frequency ensators to impro- ate models and de- bllability and obsected ds achievement PO PO PO 7 8 9	y response n ve system po termine the ervability. of Progr PO PO 10 11	s and absolute erion and root nethods. erformance response. am Outcomes PO 12												
of LTI system g-Lead compo- ystems as sta epts of contro omes towar PO PO 5 6	as using frequency ensators to impro- ate models and de- ollability and obsection ds achievement PO PO PO 7 8 9	y response n ve system po termine the ervability. of Progr PO PO 10 11	s and absolute erion and root nethods. erformance response. am Outcomes PO 12												
of LTI system g-Lead compo- ystems as sta epts of contro omes towar PO PO 5 6	as using frequency ensators to impro- ate models and de- ollability and obsec- ds achievement PO PO PO 7 8 9	y response n ve system po termine the ervability. of Progr PO PO 10 11	s and absolute erion and root nethods. erformance response. am Outcomes PO 12												
	modeling of the optimise of first an PID controlled y of closed loce ects of design onse approa Nyquist stal proach for ar and observation tion of the unction of phy- ng block diagonse specification	External I modeling of physical systems oph to determine overall transf use of first and second order sy PID controllers. y of closed loop systems using ects of design and compensa- onse approaches for the anal l Nyquist stability criterion. oroach for analysis of LTI sys- and observability. tion of the course, the unction of physical systems and onse specifications of second of of LTI systems using Routh's s	External Marks: modeling of physical systems and to use ph to determine overall transfer function use of first and second order systems and it PID controllers. y of closed loop systems using Routh's sta- ects of design and compensation of LTI onse approaches for the analysis of LTI l Nyquist stability criterion. oroach for analysis of LTI systems and u and observability. tion of the course, the student unction of physical systems and determina ng block diagram algebra and signal flow g												

UNIT I

Mathematical Modelling of Control Systems Classification of control systems open loop and closed loop control systems and their differences - Feedback characteristics - transfer function of linear system, differential equations of electrical networkstranslational and rotational mechanical systems - transfer function of Armature voltage controlled DC servo motor - block diagram algebra - signal flow graph – reduction using Mason's gain formula.

UNIT II

Time Response Analysis and Controllers Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - effects of proportional (P) - proportional integral (PI) - proportional derivative (PD) - proportional integral derivative (PID) systems.

Stability Assessment Techniques The concept of stability – Routh's stability criterion – limitations of Routh's stability, root locus concept – construction of root loci (simple problems) - Effect of addition of Poles and Zeros to the transfer function.

UNIT III

Frequency Response Analysis Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram –Polar plots, Nyquist stability criterion-stability analysis using Bode plots (phase margin and gain margin).

UNIT IV

Classical Control Design Techniques Lag, lead, lag-lead compensators - physical realisation - design of compensators using Bode plots.

UNIT V

State Space Analysis of Linear Time Invariant (LTI) Systems Concepts of state - state variables and state model - state space representation of transfer function - diagonalization using linear transformation - solving the time invariant state equations - State Transition Matrix and its properties- concepts of controllability and observability.

TEXT BOOKS:

1. Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India

2. Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 2nd Edition.

REFERENCE BOOKS:

1. Control Systems principles and design by M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4thEdition.

2. Control Systems Engineering by Norman S. Nise, Wiley Publications, 7th edition

3. Control Systems by Manik Dhanesh N, Cengage publications.

4. Control Systems Engineering by I.J.Nagarath and M.Gopal, Newage International Publications, 5 th Edition.

RENEWABLE ENERGY SOURCES (Open Elective-I)

Lecture -	- Tuto	rial:	3	-1 Hou	Irs		Int	ernal	Marks	5:	3	0
Credits:			3	5			Ext	ternal	Mark	s:	7	0
Course C	bjecti	ves:										
> To	study t	he sol	ar radi	iation d	ata, e	equival	ent c	ircuit o	of PV c	ell and	d its I-	V & P-V
cha	racteris	stics.										
> To	underst	tand th	le conc	ept of W	Vind I	Energy	Conv	version	& its a	pplicat	tions.	
> To :	study tl	he prin	ciples	of biom	ass a	nd geot	therm	al ener	gy.			
> To	underst	tand th	e prin	ciples of	f Oce	an The	rmal	Energy	Conve	ersion	(OTEC)	, motion
of v	vaves a	nd pow	ver ass	ociated	with	it.						
> To	study	the va	rious o	chemica	l ene	ergy so	urces	s such	as fue	ell cell	and h	ydrogen
ene	rgy alo	ng with	h their	operatio	on an	d equiv	valent	circuit	t .			
Course Ou	tcomes											
Upon si	icces	sful c	omp	letion	of t	the co	ours	e, the	e stu	dent	will b	e able
to:												
CO1	Analy	ze sola	ar radi	ation da	ata, e	extra-te	errest	rial rac	liation	, radia	tion or	ı earth's
	surfac	ce and	solar E	Energy S	Storag	ge.						
CO2	Illustr	rate the	e comp	onents	of wi	nd ener	rgy sy	rstems				
CO3	Illustr	rate the	e worki	ing of bi	iomas	ss, dige	sters	and Ge	eotherr	nal pla	nts	
CO4	Demo	onstrate	e the p	rinciple	of Er	nergy p	roduc	ction fr	om OT	EC, Tio	lal and	Waves.
CO5	Evalu	ate the	e conce	pt and	worki	ing of F	uel c	ells pov	ver ger	eratio	n	
CO6	Evalu	ate the	e conce	pt and	worki	ing of $[$	MHD	power	genera	tion		
Contributi	on of	Cour	se Ou	utcomes	to	wards	achie	evemen	t of	Progr	am O	utcomes
(1 - Low, 2)		PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
CO1												
CO2												
CO3												
CO4												
005												
006												

UNIT I

Solar Energy: Introduction - Renewable Sources - prospects, Solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.

UNIT II

Wind Energy: Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations -

basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.

UNIT III

Biomass and Geothermal Energy: Biomass: Introduction - Biomass conversion technologies - Photosynthesis, factors affecting Bio digestion - classification of biogas plants - Types of biogas plants - selection of site for a biogas plant Geothermal Energy: Introduction, Geothermal Sources – Applications - operational and Environmental problems.

UNIT IV

Energy From oceans, Waves & Tides: Oceans: Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India. Waves: Introduction - Energy and Power from the waves - Wave Energy conversion devices. Tides: Basic principle of Tide Energy -Components of Tidal Energy.

UNIT V

Chemical Energy Sources: Fuel Cells: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications.

Hydrogen Energy: Introduction - Methods of Hydrogen production - Storage and Applications

Magneto Hydro Dynamic (MHD) Power generation: Principle of Operation - Types. TEXT BOOKS:

1. G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011.

2. John Twidell & Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.

REFERENCE BOOKS:

1. S.P.Sukhatme & J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011.

2. John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013.

3. Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015.

CONCEPTS OF OPTIMIZATION TECHNIQUES (Open Elective-I)

Lecture -	Tuto	rial:	ć	3-1 Ho	ours		Inte	erna	1 Mar	ks:		30		
Credits:				3			Ext	erna	l Mar	ks:		70		
Course O	bjecti	ves:												
> To l	know tl	he imp	ortanc	e of ad	lopting	optim	ization	tech	nique	s in da	ay to da	ay life.		
> To a	nalyse	e the in	nporta	nce of	various	types	of con	istrai	nts at	vario	us stag	ges.		
> To	learn r	nore of	n linea	r & no	nlinear	progr	ammin	ig coi	ncepts	5.				
> To a	nalyse	e the si	gnifica	nce of	transp	ortatio	on prot	olem.						
> To	learn t	he con	cepts	of dyna	amic pr	ogram	ıming.							
Course Out	Jutcomes													
Upon su	Icces	sful o	comp	letio	n of t	he c	ourse	e, tł	ne st	uder	nt wil	l be able		
to:														
CO1	State	and fo	ormula	ate the	optimi	zatior	n probl	em v	vithou	t and	with c	onstraints,		
	also a	apply c	lassica	al optir	nizatior	n tech	niques	to n	ninimi	ze or i	maximi	ze a multi-		
	varial	variable objective function, without or with constraints and arrive at an												
	optim	optimal solution.												
CO2	Form	Formulate a mathematical model and apply linear programming technique by												
	using	using Simplex method. Also extend the concept of dual Simplex method for												
	optimal solutions.													
CO3	Form	ulate	a ma	athema	itical 1	model	and	app	ly no	on-line	ear pr	ogramming		
	techn	iques	for uno	constra	ained an	nd cor	istrain	ed ca	ise stu	idies.				
CO4	Solve	trans _i	portati	on and	d assigi	nment	proble	em b	y usu	ng Lin	lear pr	ogramming		
	Simp.	lex me	thod.											
C05	Form	ulate I	Jynam	ic pro	grammı	ng teo	chniqu	e to :	invent	ory co	ontrol,	production		
	plann	ung, ei	nginee	ring de	esign p	robler	ns etc.	to r	each a	a lina.	l optim	al solution		
<u> </u>	Irom		rrent o	ptimai	solutio	n.						maduation		
00	Apply	Dyna Dyna	amic I	prograi	nming	techi	iique	to in	ivento	ry co finai	ntrol,	production		
	from	the out	rront o	ning u		robiei	ns etc.	10 1	each a	a mia	opum	ai solution		
Contributio						varde	achie	veme	nt o	f Pr	ogram	Outcomes		
(1 – Low, 2	- Mediu	1m, 3 –	High)	200011		arus	utillt				-5-um	Jucomos		
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO		
<u> </u>	1	2	3	4	5	6	7	8	9	10	11	12		
CO2	3	4	1	1							1			
CO3	3	3	1	1							1			
C04	3	3	1	1							1			
CO5	3	3	1								1			
	•	2	1	t	1						1	1		

UNIT I

Introduction to Optimization Techniques Statement of an Optimization problem – design vector – design constraints – objective function – classification of Optimization problems.

Classical Optimization Techniques Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers.

UNIT II

Linear Programming Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

UNIT III

Nonlinear Programming

Unconstrained cases - One – dimensional minimization methods: Classification - Fibonacci method and Quadratic interpolation method - Univariate method - Powell's method.

Constrained cases - Characteristics of a constrained problem - Classification - Basic approach of Penalty Function method.

UNIT IV

Transportation Problem Finding initial basic feasible solution by north – west corner rule - least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems – Special cases in transportation problem

UNIT V

Dynamic Programming Dynamic programming - Multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution

TEXT BOOKS:

Text Books: 1. "Engineering optimization: Theory and practice"-by S. S.Rao- New Age International (P) Limited - 3rd edition - 1998.

2. "Introductory Operations Research" by H.S. Kasene& K.D. Kumar - Springer (India) 2013.

REFERENCE BOOKS:

1. "Optimization Methods in Operations Research and systems Analysis" – by K.V. Mital and C. Mohan - New Age International (P) Limited - Publishers - 3 rd edition - 1996.

2. Operations Research - by Dr. S.D.Sharma- Kedarnath - Ramnath& Co - 2012.

3. "Operations Research: An Introduction" – by H.A.Taha - PHI pvt. Ltd. - 6th edition

4. Linear Programming-by G.Hadley.

CONCEPTS OF CONTROL SYSTEMS (Open Elective-I)

Lecture	- Tuto	rial:		3-1 Ho	ours		Inte	erna	1 Mar	ks:		30
Credits:				3			Ext	erna	l Mar	ks:		70
Course C	Course Objectives:											
> To	learn the mathematical modeling of physical systems and to use block diagram											
alg	ebra an	ıd sign	al flow	graph	to dete	ermine	e overal	ll tra	nsfer f	unctio	on	
≻ To	analyze	e the ti	me res	ponse	of first	and s	econd	order	syste	ms ar	ıd impr	ovement of
per	forman	ice usii	ng PI, I	PD, PII) contr	ollers.						
≻ To	investi	gate th	e stab	ility of	closed	l loop	system	is us	ing Ro	outh's	stabili	ty criterion
and	l root le	ocus m	ethod.									
≻ To	learn l	Freque	ncy Re	espons	e appr	oache	s for t	he a	nalysi	s of L	.TI syst	ems using
Boo	le plots	s, polar	[.] plots	and Ny	yquist :	stabilit	ty crite	rion.				
> To	learn	state s	space	approa	ach for	analy	rsis of	LTI	systen	is an	d unde	rstand the
cor	cepts o	of contr	rollabil	ity and	1 obser	vabilit	у.					
Course Outcomes												
Upon successful completion of the course, the student will be able												
to:												
CO1	Derive the transfer function of physical systems and determination of overall											
	trans	fer fun	ction ι	asing t	olock di	iagram	algebi	ra an	d sign	al flov	v graph	IS.
CO2	Deter	mine	time 1	respon	se spe	ecificat	ions o	of se	cond	order	syster	ns and to
	deter	mine e	rror co	nstant	ts							
CO3	Analy	ze abs	olute	and re	lative	stabilit	y of L'	ГI sy	stems	using	g Routh	n's stability
	criterion and the root locus method.											
CO4	Analyze the stability of LTI systems using frequency response methods.								ods.			
CO5	Represent physical systems as state models and determine the response.								onse.			
CO6	Unde	rstand	ing the	e conce	epts of	contro	llabilit	y and	1 obse	rvabili	ity.	
Contributi	on of Modi	Cou	rse O	utcom	es to	wards	achie	veme	ent o	f Pro	ogram	Outcomes
(1 - Low, 2	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2									1	
CO2	3	3	1	1							1	
CO3	3	3	1	1							1	
C04	3	3	1	1							1	
C05	3	<u>১</u> 2	1								1	
	3	3	L								1	

UNIT I

Mathematical Modelling of Control Systems Classification of control systems open loop and closed loop control systems and their differences - transfer function of linear system - differential equations of electrical networks - translational and rotational mechanical systems – block diagram algebra – Feedback characteristics.

UNIT II

Time Response Analysis Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - P - PI & PID Controllers.

UNIT III

Stability and Root Locus Technique The concept of stability – Routh-Hurwitz Criteria – limitations of Routh-Hurwitz criterion-.Root locus concept – construction of root loci (simple problems).

UNIT IV

Frequency Response Analysis Introduction to frequency domain specifications – Bode diagrams – Transfer function from the Bode diagram – phase margin and gain margin.

UNIT V

State Space Analysis of Linear Time Invariant (LTI) Systems Concepts of state - state variables and state model - state space representation of transfer function - State Transition Matrix and it's properties - concepts of controllability and observability.

TEXT BOOKS:

1. Modern Control Engineering by Kotsuhiko Ogata - Prentice Hall of India.

2. Automatic control systems by Benjamin C.Kuo - Prentice Hall of India - 2 nd Edition.

REFERENCE BOOKS:

1. Control Systems principles and design by M.Gopal - Tata Mc Graw Hill education Pvt Ltd. - 4 thEdition.

2. Control Systems by Manik Dhanesh N - Cengage publications.

3. Control Systems Engineering by I.J.Nagarath and M.Gopal - Newage International Publications - 5 th Edition.

4. Control Systems Engineering by S.Palani - Tata Mc Graw Hill Publications.

LINEAR IC APPLICATIONS (Professional Elective-I)

Lecture -	Tuto	rial:		3-1 Ho	ours		Inte		30			
Credits:				3			Ext	erna	1 Mar	ks:		70
Course O	bjectives:											
> Des	cribe t	he Op-	Amp a	nd int	ernal C	ircuitı	y: 555	Time	er, PLI			
> Dise	cuss the Applications of Operational amplifier: 555 Timer, PLL											
> Des	ign the	e Active	e filters	s using	g Opera	tional	Amplif	lier				
> Use	the Op	p-Amp	in A to	D & I	D to A C	Convei	rters					
Course Out	ourse Outcomes											
Upon su	Upon successful completion of the course, the student will be able											
to:												
CO1	Desci	ribe the	e Op-A	mp an	d interi	nal Ci	rcuitry	: 555	Timer	r, PLL		
CO2	Discu	iss the	Applic	ations	of Ope	ration	al amp	lifier	: 555 ′	Timer		
CO3	Discu	iss the	Applic	ations	of Ope	ration	al amp	lifier	: PLL			
CO4	Desig	n the A	Active	filters 1	using O	perati	ional A	mplif	ier			
CO5	Use t	he Op-	Amp ii	n D to	A Conv	verters	3					
CO6	Use t	he Op-	Amp ii	n A to I	D Conv	erters						
Contributio	on of	Cour	rse O	utcom	es tov	vards	achie	veme	nt o	f Pro	ogram	Outcomes
(1 – Low, 2	- Mediu	1m, 3 –	High)									
	PO 1	PO 2	PO 3	PO 4	PO 5	P0 6	PO 7	PO 8	PO Q	PO 10	PO 11	PO 12
CO1	3	2	•	•	0				-	10	1	12
CO2	3	3	1	1						-	1	
CO3	3	3	1	1							1	
CO4	3	3	1	1							1	
CO5	3	3	1								1	
CO6	3	3	1								1	

UNIT I

OP-Amp Block Diagram (Symbolic Representation), Characteristics of Op-Amp, Ideal and Practical OpAmp specifications, DC and AC Characteristics, Definitions of Input and Output Off-set voltage and currents slow rate, CMRR, PSRR. Measurements of Op-Amp Parameters, Three-Terminal Voltage Regulators 78xx& 79xx Series, current Booster, adjustable voltage, DualPowerSupplywith78xx&79xx

UNIT II

OP-AMPS Applications: Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.

Comparators and Waveform Generators: Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators.

UNIT III

Active Filters: Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters.

UNIT IV

Timers: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger.

Phase Locked Loops: Introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of VCO (566)

UNIT V

Digital To Analog And Analog To Digital Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.DAC and ADC Specifications.

TEXT BOOKS:

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition 2003.

2. Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma; SK Kataria & Sons; 2 nd Edition, 2010

REFERENCE BOOKS:

1. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1993.

2. Operational Amplifiers & Linear ICs – David A Bell, Oxford Uni. Press, 3rd Edition.

UTILIZATION OF ELECTRIC ENERGY (Professional Elective-I)

Lecture ·	- Tuto	rial:		5-1 П(Juis	Internal Marks:							
Credits:				3			Ext	erna	1 Maı	ks:		70	
Course C)bjecti	ves:											
≻ To	study t	he bas	sic prir	nciples	of illu	minat	ion and	d its	meası	ıreme	nts an	d to design	
the	differe	nt type	es light	ing sys	stems.								
> To	acquair	nt with	the di	fferent	t types	of hea	ting ar	d we	lding	techni	ques.		
> To	unders	tand t	he ope	rating	princip	oles ar	nd cha	racte	ristics	of va	rious r	notors with	
res	pect to	speed,	tempe	erature	e and lo	ading	condit	ions.					
≻ To	understand the basic principles of electric traction including speed-time curves												
of	differen	t tract	tion se	ervices	and c	alcula	tion o	f bra	king,	accele	eration	and othe	
rela	ated par	ramete	rs.										
≻ To	Introdu	uce the	e conce	epts of	various	s types	s of end	ergy s	storag	e syste	ems.		
Course Ou	tcomes												
Upon si	ıcces	sful d	comp	letio	n of t	he c	ourse	e, th	le st	uder	nt wil	l be able	
t o:			_										
C O 1	Ident	ify var	rious	illumir	nation	metho	ods pr	oduce	ed by	diffe	rent i	luminating	
	sources.												
	sourc	es.											
02	Ident	es. ify a sι	uitable	motor	for ele	ctric d	rives a	nd in	dustr	ial ap	plicatio	ons	
CO2 CO3	Ident:	es. ify a su ify mo	iitable ost ap	motor propri	for elecate he	ctric d ating	rives a and	nd in weldi	dustr ng te	ial apj chniq	plicatio ues fo	ons or suitable	
CO2 CO3	Ident: Ident: applie	es. ify a su ify mo cations	uitable ost ap	motor propri	for electricate electricate for electricate electricat	ctric d ating	rives a and	nd in weldi	dustr ng te	ial apj echniq	plicatic ues fo	ns or suitable	
202 203 204	Ident: Ident: applie Distir	ees. ify a su ify mo cations nguish	uitable ost ap s. variou	motor propri	for electricate he	ctric d eating stem	rives a and	nd in weldi	ldustr ng te	ial apj chniq	plicatio ues fo	ons or suitable	
CO2 CO3 CO4 CO5	Ident: Ident: applie Distin Deter	ees. ify a su ify mo cations nguish mine t	uitable ost ap o. variou he trac	motor propri	for electric to the test of test o	ctric d eating stem d spec	rives a and	nd in weldi	dustr ng te consu:	ial app echniq	plicatio ues fo n.	ons or suitable	
CO2 CO3 CO4 CO5 CO6	Ident: Ident: applie Distir Deter Valida	tes. ify a su ify mo cations nguish mine t ate the	uitable ost ap s. variou he trac e nece	motor propri is tract	for electric for electric for electric for electric for the system of th	ctric d cating stem d spec	rives a and rific eno	nd in weldi ergy o rent	dustr ng te consu: energ	ial app echniq mption	plicatic ues fo n. rage so	ons or suitable chemes fo	
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Various Illumination Methods Discharge lamps - MV and SV lamps - Comparison between tungsten filament lamps and fluorescent tubes-Basic principles of light control- Types and design of lighting and flood lighting-LED lighting - Energy conservation.

UNIT II

Selection of Motors Choice of Motor - Type of Electric Drives - Starting And Running Characteristics – Speed Control– Temperature Rise – Applications of Electric Drives–Types of Industrial Loads–Continuous–Intermittent And Variable Loads–Load Equalization -Introduction To Energy Efficient Motors.

UNIT III

Electric Heating Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating

Electric Welding Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding.

UNIT IV

Electric Traction System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor– Mechanics of train movement–Speed–time curves for different services – Trapezoidal and quadrilateral speed time curves. Calculations of tractive effort– power – Specific energy consumption for given run–Effect of varying acceleration and braking retardation– Adhesive weight and braking retardation adhesive weight and coefficient of adhesion-Numerical problems.

UNIT V

Introduction to Energy Storage Systems Need For Energy Storage - Types of Energy Storage-Thermal - Electrical - Magnetic And Chemical Storage Systems - Comparison of Energy Storage Technologies-Applications.

TEXT BOOKS:

1. Utilization of Electric Energy – by E. Openshaw Taylor - Orient Longman.

2. Art & Science of Utilization of electrical Energy - by Partab - Dhanpat Rai& Sons.

3. "Thermal energy storage systems and applications"-by Ibrahim Dincer and Mark A.Rosen. John Wiley and Sons 2002.

REFERENCE BOOKS:

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana - New Age International (P) Limited - Publishers - 1996.

2. Generation - Distribution and Utilization of electrical Energy – by C.L. Wadhwa - New Age International (P) Limited - Publishers - 1997.

COMPUTER ARCHITECTURE AND ORGANIZATION (Professional Elective-I)

Lecture -	- Tuto	rial:		3-1 Ho	ours	Internal Marks: 30						
Credits:			3	3 External Marks: 70								70
Course O	bjecti	ves:										
> To e	explain the basic working of a digital computer.											
> To	understand the register transfer language and micro operators.											
≻ To	learn various addressing modes supported by the processors.											
> To	be fam	iliar w	ith per	riphera	l interf	acing	with pi	coces	sors.			
Το ι	unders	tand m	nemory	hiera	rchy in	comp	uters.					
Course Out	tcomes											
Upon su	icces	sful o	comp	letio	n of t	the c	ourse	e, th	ne st	uder	nt wil	l be able
to:												
CO1	Explain the instruction cycle of a computer											
CO2	Understand various micro operations											
CO3	Unde	rstand	variou	is regi	ster tra	nsfer 1	langua	ge.				
CO4	Desci	ribe pa	rallel p	process	sing an	d pipe	lining.					
CO5	Interf	ace dif	ferent	periph	ierals v	vith pr	ocesso	rs.				
CO6	Know	the ac	lvanta	ges of	cache a	and vii	rtual m	iemoi	ry.			
Contributi	on of	Cour	rse O	utcom	es to	wards	achie	veme	ent o	of Pro	ogram	Outcomes
(1 - Low, 2)	- Mediu	1m, 3 -	High)	DO	BO	DO	BO	DO	DO	DO	BO	BO
	1	2	3	4	5	6	F0 7	8	9	10	11	12
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CO2	3	3	1	1							1	
CO3	3	3	1	1							1	
CO4	3	3	1	1							1	
CO5	3	3	1								1	
C06	3	3	1								1	

UNIT I

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic

UNIT II

Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit. Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

UNIT III

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer(RISC) Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISK Pipeline, Vector Processing, Array Processors.

UNIT IV

Input/output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output Processor (IOP), Serial Communication.

UNIT V

Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

TEXT BOOKS:

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., 3 rd Edition, Sept. 2008.

REFERENCE BOOKS:

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.

2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN 81-7319-609-5

3. Computer System Organization by John. P. Hayes.

OPTIMIZATION TECHNIQUES (Professional Elective-I)

Lecture -	- Tutorial: 3-1 Hours Internal Marks: 30										30	
Credits:			ć	3			Ext	erna	l Mar	ks:		70
Course O	Course Objectives:											
> To le	know tl	he imp	ortanc	e of ad	lopting	optim	ization	tech	nique	s in da	ay to da	ay life.
> To a	analyse the importance of various types of constraints at various stages.											
> To	o learn more on linear & nonlinear programming concepts.											
> To a	o analyse the significance of transportation problem.											
> To	To learn the concepts of dynamic programming.											
Course Out	Course Outcomes											
Upon su	lcces	sful o	comp	letio	n of t	he c	ourse	e, tł	ne sti	uder	it wil	l be able
to:												
CO1	State	and fo	ormula	ate the	optim	ization	ı probl	em v	vithou	t and	with c	onstraints,
	also a	apply c	lassica	al optir	nizatio	n tech	niques	to n	ninimi	ze or 1	maximi	ze a multi-
	varial	ble ob	jective	funct	ion, w	ithout	or wi	th c	onstra	ints a	and ar	rive at an
	optimal solution.											
CO2	Formulate a mathematical model and apply linear programming technique by											
	using Simplex method. Also extend the concept of dual Simplex method for											
	optim	al solu	itions.									
CO3	Form	ulate	a ma	athema	atical	model	and	app	ly no	n-line	ear pr	ogramming
	techn	iques	for uno	constra	ained a	nd cor	nstrain	ed ca	lse stu	dies.		
CO4	Solve	trans	portati	on and	d assig	nment	t probl	em t	y usir	ng Lin	lear pr	ogramming
	Simp	lex me	thod.									
CO5	Form	ulate I	Dynam	ic pro	gramm	ing teo	chniqu	e to	invent	ory co	ontrol,	production
	planning, engineering design problems etc. to reach a final optimal solution											
	from	the cu	rrent o	ptimal	solutio	on.						
CO6	Apply Dynamic programming technique to inventory control, production											
	planning, engineering design problems etc. to reach a final optimal solution											
	from	the cu	rrent o	ptimal	solutio	on.	1			6 D		0
(1 - Low, 2)	on oi - Medii		rse U High)	utcom	es tov	varas	аспіе	veme	ent o	I Pro	ogram	Outcomes
	PO	PO	PO	PO	PO	PO	РО	PO	PO	PO	РО	РО
001	1	2	3	4	5	6	7	8	9	10	11	12
	3	2	1	1							1	
CO2	<u>১</u> ২	<u>১</u> ৫	1	1							1	
C03	3	3	1	1							1	
C05	3	3	1								1	
CO6	3	3	1								1	

UNIT I

Introduction to Optimization Techniques Statement of an Optimization problem – design vector – design constraints – objective function – classification of Optimization problems.

Classical Optimization Techniques Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers.

UNIT II

Linear Programming Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

UNIT III

Nonlinear Programming

Unconstrained cases - One – dimensional minimization methods: Classification - Fibonacci method and Quadratic interpolation method - Univariate method - Powell's method.

Constrained cases - Characteristics of a constrained problem - Classification - Basic approach of Penalty Function method.

UNIT IV

Transportation Problem Finding initial basic feasible solution by north – west corner rule - least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems – Special cases in transportation problem

UNIT V

Dynamic Programming Dynamic programming - Multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution

TEXT BOOKS:

Text Books: 1. "Engineering optimization: Theory and practice"-by S. S.Rao- New Age International (P) Limited - 3rd edition - 1998.

2. "Introductory Operations Research" by H.S. Kasene& K.D. Kumar - Springer (India) 2013.

REFERENCE BOOKS:

1. "Optimization Methods in Operations Research and systems Analysis" – by K.V. Mital and C. Mohan - New Age International (P) Limited - Publishers - 3 rd edition - 1996.

2. Operations Research – by Dr. S.D.Sharma- Kedarnath - Ramnath& Co - 2012.

3. "Operations Research: An Introduction" – by H.A.Taha - PHI pvt. Ltd. - 6th edition

4. Linear Programming-by G.Hadley.

OBJECT ORIENTED PROGRAMMING THROUGH JAVA (Professional Elective-I)

Lecture -	- Tuto	rial:		3-1 Ho	ours		Inte		30			
Credits:	External Marks: 70										70	
Course O	Objectives:											
≻ Imp	lement	ing pr	ogram	s for u	ser int	erface	and a	pplic	ation	develo	pment	using core
java	a principles											
Course Out	tcomes											
Upon su	Icces	sful o	comp	letio	n of t	he c	ourse	e, th	ie st	uden	t wil	l be able
to:												
CO1	Discuss and understand java programming constructs.											
CO2	Discuss and understand Control structures											
CO3	Illustrate and experiment Object Oriented Concepts like classes, objects											
CO4	Apply Object Oriented Constructs such as Inheritance, interfaces, and											
	excep	tion ha	andling	g								
CO5	Const	truct a	pplicat	tions u	sing m	ultith	reading	g and	I/O			
CO6	Devel	op Dyr	namic	User Ir	nterface	es usir	ıg appl	lets a	nd Ev	ent Ha	andling	in java
Contributio	on of	Cou	rse O	utcom	es tov	vards	achie	veme	ent o	f Pro	ogram	Outcomes
(1 - Low, 2)	- Mediu	<u>1m, 3 –</u>	High)	DO	DO		DO	DO	DO	DO	PO	PO
	PO 1	PO 2	PO 3	PO 4	PO 5	P0 6	PO 7	8	9	10	PO 11	PO 12
CO1	3	2		-	•		-				1	
CO2	3	3	1	1							1	
CO3	3	3	1	1							1	
CO4	3	3	1	1							1	
C05	3	3	1								1	
CO6	3	3	1								1	

UNIT I

Focus on object oriented concepts and java program structure and its installation, Introduction to OOP Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features.

UNIT II

Comprehension of java programming constructs, control structures in Java Programming Constructs Variables, Primitive Datatypes, Identifiers- Naming Conventions, Keywords, Literals, Operators-Binary, Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control Branching, Conditional, loops.,

UNIT III
Classes and Objects- classes, Objects, Creating Objects, Methods, constructors,
Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and
Methods-Static keyword, this keyword, Arrays, Command line arguments Interfaces and
exception handling Inheritance: Types of Inheritance, Deriving classes using extends
keyword, Method overloading, super keyword, final keyword, Abstract class Interfaces,
UNIT IV
Understanding of Thread concepts and I/O in Java MultiThreading: java.lang.Thread, The
main Thread, Creation of new threads, Thread priority, Multithreading- Using isAlive() and
join(), Syncronization, suspending and Resuming threads, Communication between
Threads.
UNIT V
Being able to build dynamic user interfaces using applets and Event handling in java
Swing: Introduction, javax.swing package, JFrame, JApplet, JPanel, Components in
swings, Layout Managers, JList and JScroll Pane, Split Pane, JTabbedPane, Dialog Box.
TEXT BOOKS:
1. The Complete Refernce Java, 8ed, Herbert Schildt, TMH
2. Programming in JAVA, Sachin Malhotra, Saurabh choudhary, Oxford.
REFERENCE BOOKS:
1. JAVA Programming, K.Rajkumar.Pearson
2. Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech
3. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
. Object oriented programming with JAVA, Essentials and Applications, Raj Kumar
Bhuyya, Selvi, Chu TMH
5. Introduction to Java programming, 7th ed, Y Daniel Liang, Pearson Core JAVA
for Beginners, Rashmi Kanta Das, Vikas.
6. Object Oriented Programming through JAVA , P Radha Krishna , University Press
CONTROL SVOTEMS I AD

Lecture – Tutorial:		Internal Marks:	15
Credits:	1.5	External Marks:	35
 To impart hands or system component 	n experience to unde s such as magnetic a	erstand the performance of ba amplifiers	sic control
To understand tim controllers and cor	e and frequency resp npensators.	oonses of control system with	and without
	List of	Experiments	
(Any 10 of the follo	wing experiments	are to be conducted)	
1. Time response of Se	cond order system		
2. Characteristics of S	ynchros		
3. Effect of P, PD, PI, F	ID Controller on a se	econd order systems	
4. Design of Lag and l	ead compensation –	Magnitude and phase plot	
5. Transfer function of	DC motor		
6. Bode Plot, Root locu order using MATLAB.	s, Nyquist Plots for t	the transfer functions of syste	ems up to 5th
7. Controllability and	Observability Test us	sing MAT LAB.	
8. Temperature contro	oller using PID		
9. Characteristics of m	agnetic amplifiers		
10. Characteristics of	AC servo motor		
11. Characteristics of	DC servo motor		
12. To study and verify using PLC.	v the truth table of lo	ogic gates and simple Boolear	expressions
using PLC.			

POWER ELECTRONICS LAB

Lecture – Tutorial:	3-0 Hours	Internal Marks:	15
Credits:	1.5	External Marks:	35
Course Objectives:			
 To learn the characteristic circuits and comm 	cteristics of varior utation circuits o	us power electronic devices and an f SCR.	alyze firing
To analyze the pe converters with bo	rformance of sing th resistive and in	gle–phase and three–phase full–way	ve bridge

- To understand the operation of AC voltage regulator with resistive and inductive loads.
- > To understand the working of Buck converter and Boost converter.
- > To understand the working of single-phase & three-phase inverters.

List of Experiments

(Any 10 of the following experiments are to be conducted)

- 1. Characteristics of SCR Power MOSFET & Power IGBT.
- 2. R RC & UJT firing circuits for SCR.
- 3. Single -Phase semi-converter with R & RL loads.
- 4. Single -Phase full-converter with R & RL loads.
- 5. Three- Phase full-converter with R & RL loads.

6. Single-phase dual converter in circulating current & non circulating current mode of operation.

7. Single-Phase AC Voltage Regulator with R & RL Loads.

8. Single-phase step down Cycloconverter with R & RL Loads.

9. Boost converter in Continuous Conduction Mode operation.

- 10. Buck converter in Continuous Conduction Mode operation.
- 11. Single -Phase square wave bridge inverter with R & RL Loads.
- 12. Single Phase PWM inverter.
- 13. Three-phase bridge inverter with 1200 and 1800 conduction mode
- 14. SPWM control of Three-phase bridge inverter

ANALYSIS OF LINEAR SYSTEMS

(Minors Engineering Course)

Lecture – Tut	orial:		3-1 Ho	ours		Int	erna	1 Mar	ks:		30		
Credits:			3			Ext	erna	1 Mai	rks:		70		
Course Object	ives:												
≻ To formu	ate stat	e equa	ation fo	or elect	trical n	etwork	s and	analy	vsis sim	nple ne	tworks with		
statevaria	ble appr	oach											
To analyze	e the sigr	nals app	olied to	electri	cal netv	vorks a	nd the	eorems	5.				
🕨 🕨 To examir	e the ap	plicatio	ons of Fo	ourier s	series, F	ourier	transf	orm to	simple	e circuit	S.		
🕨 To know t	he distin	ction b	etween	Laplac	e, Four	ier and	Z-Tra	nsform	าร.				
🕨 To evalua	e testing	g of pol	ynomia	ls and i	networl	< synth	esis of	f LC, RO	C and R	Lnetw	orks.		
Course Outcome	s					-							
Upon succe	ssful o	comp	letio	n of	the c	ours	e, tł	ne st	uder	it wil	l be able		
to:													
CO1 Solv	e problei	ms invo	lving co	ontinuc	ous time	signal	s and	linear	system	S			
CO2 Use	Use the Laplace transform to analyse signals, linear circuits and systems.												
CO3 Use	the Four	ier serie	es and tr	ransfor	m to an	alyse si	gnals.						
CO4 Solv	e problei	ms invo	olving di	iscrete	time sig	gnals ar	d line	ear syst	tems.				
CO5 illus	rate testi	ing of p	olynom	nials									
CO6 illus	rate netv	vork sy	nthesis	of LC,	RC and	l RL ne	twork	as.					
Contribution of	f Cou	rse O	utcom	es to	wards	achie	eveme	ent o	of Pro	ogram	Outcomes		
$\frac{1 - Low, 2 - Med}{PO}$	PO	PO	PO	PO	PO	PO	PO	PO	PO	РО	PO		
1	2	3	4	5	6	7	8	9	10	11	12		
CO1													
CO2													
CO3													
C05													
CO6									1				
I	<u> </u>	1	1 1	1	UNIT	[1	I	1		I		

State Variable Analysis

Choice of state variables in Electrical networks-Formulation of state equations for Electrical networks-Equivalent source method. Network topological method - Solution of state equations-Analysis of simple networks with state variable approach

UNIT II

Laplace Transform Applications

Application of Laplace transform methods of analysis:

Response of RL, RC and RLC networks to step, ramp, pulse and impulse functions, shifting and scaling theorems-Laplace transform of periodic functions-Convolution theorem-Convolution integral- Applications.

UNIT III

Application of Fourier Series and Fourier Transform

Fourier Series: RMS, average value of a non-sinusoidal periodic wave form-Expression for power with non sinusoidal voltage and current-Power factor-Effect of harmonics-Analysis of simple circuits with non-sinusoidal inputs.

Fourier Transform: Representation of non-periodic functions-Fourier integral-Fourier transform- Graphical Representation-Properties of Fourier transforms-Parseval's theorem-Fourier transform of constant, unit step, unit impulse, unit ramp signals and exponential functions-relationship with Laplace transform

UNIT IV

Z-Transforms

Fundamental difference between continuous and discrete time signals, discrete time complex, exponential and sinusoidal signals, periodicity of discrete time complex exponential, concept of Z-Transform of a discrete sequence. Distinction between Laplace, Fourier and Z-Transforms. Region of convergence in Z- Transforms, constraints on ROC for various classes of signals, Inverse Z-Transform properties of Z- Transforms.

UNIT V

Testing of Polynomials and Network synthesis:

Elements of reliability-Hurwitz polynomials-positive real functions-Properties-Testing-Sturm's Test, examples.

Network synthesis:

Synthesis of one port LC networks-Foster and Cauer methods-Synthesis of RL and RC one port networks-Foster and Cauer methods.

TEXT BOOKS:

1. Signals, Systems and Communications by B.P. Lathi, BS Publications 2003.

2.Network Analysis and Synthesis – B C Kuo

3.Network Analysis and Synthesis – Umesh Sinha- Satya Prakashan Publicatio

REFERENCE BOOKS:

1.Linear System Analysis – A N Sripathi, New Age International

2.Network and Systems – D Roy Chowdhary, New Age International

3. Engineering Network Analysis and Filter Desgin- Gopal G Bhise & Um

ENERGY AUDITING, CONSERVATION AND MANAGEMENT

(Minors Engineering Course)

Lecture	e – Tuto	rial:	3	3-1 Ho	ours		Int	erna	1 Mar	ks:		30
Credits	•		3	3			Ext	erna	1 Maı	ks:		70
Course	Objecti	ves:										
➤ Te	o understa	and bas	ic conc	epts of	Energy	Audit 8	& variou	us Ene	ergy co	nserva	tion sch	nemes
> To	o design e	nergy a	in energ	gy mana	agemer	nt progr	ram.					
≻ то	o understa	and con	icept of	Energy	y Efficie	nt Mot	ors and	light	ing cor	ntrol ef	ficienci	es.
➤ Te	o estimat	te/calcu	ilate p	ower	factor	of sys	tems a	and p	ropos	e suita	able co	ompensation
te	chniques											
≻ то	calculat	e life	cycle c	osting	analys	is and	return	on	investr	nent d	on ene	rgy efficient
te	chnologie	es.	-	_								
Course C	utcomes											
Upon	succes	sful d	comp	letio	n of	the c	ourse	e, tł	ne st	uder	nt wil	l be able
to:												
CO1	Understa	and the	princip	les of e	energy a	audit al	ong wit	h vari	ous Er	ergy re	elated	
	terminol	ogies.										
CO2	Asses the	e role o	f Energ	y Mana	iger and	d Energ	y Mana	geme	nt pro	gram.		
CO3	Design a	energy	efficie	nt moto	ors and	good li	ghting s	syster	n.			
CO4	Analyse	the me	thods t	o impr	ove the	e powe	r factor	-				
C05	Evaluate	the co	mputat	ional te	echniqu	es with	regard	to ec	onomi	c aspe	cts	
C06	identify	the ene	ergy ins	trumer	nts for	various	real tim	ie app	olicatio	ns.		
Contribu	tion of	Cou	rse O	utcom	es to	wards	achie	veme	ent o	of Pro	ogram	Outcomes
(I - DOW)	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
C01												
CO2												
C04												
C05												
C06								ł				

UNIT I

Basic Principles of Energy Audit

Energy audit- definitions - concept - types of audit - energy index - cost index - pie charts -Sankey diagrams and load profiles - Energy conservation schemes- Energy audit of industries- energy saving potential - energy audit of process industry - thermal power station - building energy audit - Conservation of Energy Building Codes (ECBC-2017) -

UNIT II

Energy Management

Principles of energy management - organizing energy management program - initiating - planning - controlling - promoting - monitoring - reporting. Energy manager - qualities and functions - language- Questionnaire – check list for top management

UNIT III

Energy Efficient Motors and Lighting

Energy efficient motors - factors affecting efficiency - loss distribution - constructional details - characteristics - variable speed - RMS - voltage variation-voltage unbalance-over motoring-motorenergy audit. lighting system design and practice - lighting control - lighting energy audit

UNIT IV

Power Factor Improvement And Energy Instruments

Power factor – methods of improvement - location of capacitors - Power factor with nonlinear loads -effect of harmonics on p.f - p.f motor controllers – Energy Instruments- watt meter - data loggers - thermocouples - pyrometers - lux meters - tongue test

UNIT V

Economic Aspects and Their Computation

Economics Analysis depreciation Methods - time value of money - rate of return - present worth method - replacement analysis - lifecycle costing analysis – Energy efficient motors. Calculation of simple payback method - net present value method- Power factor correction - lighting – Applications of life cycle costing analysis - return on investment

TEXT BOOKS:

1.Energy management by W.R.Murphy&G.Mckay Butter worth - Heinemann publications - 1982. 2.Energy management hand book by W.CTurner - John wiley and sons - 1982.

REFERENCE BOOKS:

1.Energy efficient electric motors by John.C.Andreas - Marcel Dekker Inc Ltd-2nd edition - 1995 2.Energy management by Paul o' Callaghan - Mc-graw Hill Book company-1st edition – 1998 3.Energy management and good lighting practice : fuel efficiency- booklet12-EEO

SUMMER INTERNSHIP

Lecture – Tutorial:	-	Internal Marks:	30
Credits:	1.5	External Marks:	70
Summer Internship	2 Months (M	andatory) after second year (to be	evaluated
during V semester			

MICROPROCESSORS AND MICROCONTROLLERS

Lecture -	Tuto	rial:		3-1 Ho	ours		Int	erna	1 Mar	ks:		30
Credits:			3	3			Ext	erna	l Maı	ks:		70
Course O	bjecti	ves:										
🎽 Το ι	unders	tand tl	ne orga	nizati	on and	archit	ecture	of M	icropr	ocesso	or	
> To	unders	stand a	address	sing m	odes to	acces	s men	iory				
🎽 Το ι	unders	tand 8	051 m	icro co	ntroller	r arch	itectur	e				
> To	unders	stand t	he pro	gramn	ning pri	inciple	es for 8	086	and 80)51		
> To	under	stand	the int	erfacir	ng of Mi	icropr	ocesso	r witł	n I/O a	as wel	l as oth	ner devices
> To	unders	stand ł	now to	develo	p cybei	r phys	ical sy	stem	S			
Course Out	comes	5										
Upon su	lcces	sful d	comp	letio	n of t	he c	ours	e, tł	ie st	uder	nt wil	l be able
to:			-									
CO1	Know	the co	oncepts	s of th	e Micro	proces	ssor ca	pabil	lity in	gener	al and	explore the
	evalu	ation o	of micro	oproce	ssors.							
CO2	Analy	vse the	instru	action	sets -	addre	ssing	mode	s - m	inimu	m and	maximum
	mode	s opera	ations	of 808	6 Micro	proce	ssors					
CO3	Analy	vse the	Micro	contro	ller and	l inter	facing	capal	bility			
CO4	Desci	ribe the	e archi	tectur	e and in	nterfa	cing of	8051	conti	oller		
CO5	Know	the co	oncepts	s of PI	C micro	contr	oller					
CO6	Know	the co	oncepts	s of PI	C micro	contr	oller p	rogra	mmin	g.		
Contributio	on of	Cou	rse O	utcom	es tov	vards	achie	eveme	ent o	of Pro	ogram	Outcomes
(1 - Low, 2)	- Mediu	1m, 3 -	High)									
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO	PO 10	PO 11	PO 12
C01	3	2	0			Ū	-			10	1	12
CO2	3	3	1	1							1	
CO3	3	3	1	1							1	
CO4	3	3	1	1							1	
CO5	3	3	1								1	
CO6	3	3	1								1	

UNIT I

Introduction to Microprocessor Architecture Introduction and evolution of Microprocessors – Architecture of 8086 – Memory Organization of 8086 – Register Organization of 8086– Introduction to 80286

UNIT II

Minimum and Maximum Mode Operations Instruction sets of 8086 - Addressing modes – Assembler directives - General bus operation of 8086 – Minimum and Maximum mode operations of 8086 – 8086 Control signal interfacing – Read and write cycle timing diagrams.

UNIT III

Microprocessors I/O interfacing 8255 PPI– Architecture of 8255–Modes of operation– Interfacing I/O devices to 8086 using 8255– Interfacing A to D converters– Interfacing D to A converters– Stepper motor interfacing– Static memory interfacing with 8086. Architecture and interfacing of 8251 USART – Architecture and interfacing of DMA controller (8257).

UNIT IV

8051 Microcontroller Overview of 8051 Microcontroller – Architecture– Memory Organization – Register set – I/O ports and Interrupts – Timers and Counters – Serial Communication – Interfacing of peripherals

UNIT V

PIC Architecture Block diagram of basic PIC 18 micro controller – registers I/O ports – Programming in C for PIC: Data types - I/O programming - logical operations - data conversion.

TEXT BOOKS:

1. Ray and Burchandi - "Advanced Microprocessors and Interfacing" - Tata McGraw–Hill - 3 rd edition - 2006. 2. Kenneth J Ayala - "The 8051 Microcontroller Architecture -Programming and Applications" - Thomson Publishers - 2nd Edition.

3. PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18 - -Muhammad Ali Mazidi - RolindD.Mckinay - Danny causey -Pearson Publisher 21st Impression.

REFERENCE BOOKS:

1. Microprocessors and Interfacing - Douglas V Hall - Mc-Graw Hill - 2 nd Edition.

2. R.S. Kaler - "A Text book of Microprocessors and Micro Controllers" - I.K. International Publishing House Pvt. Ltd.

3. Ajay V. Deshmukh - "Microcontrollers – Theory and Applications" - Tata McGraw–Hill Companies –2005.

4. Ajit Pal - "Microcontrollers – Principles and Applications" - PHI Learning Pvt Ltd - 2011.

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Lecture -	Tuto	rial:		3-1 Ho	ours		Int	erna	1 Mar	ks:		30
Credits:				3			Ext	erna	l Maı	ks:		70
Course O	bjecti	ves:										
۶ Το ι	unders	tand a	nd ana	alyze tł	ne facto	ors tha	t effect	t the	variou	is mea	suring	units.
> To	choose	e the a	ppropi	riate m	eters f	or mea	asuring	g of v	oltage	, curr	ent, po	wer, power
fact	or and	energ	y quali	ties &	unders	stand t	he cor	ncept	of sta	ndard	ization	
Des	cribe	the op	peratir	ng pri	nciple	of AC	C & I	DC b	oridges	s for	meası	arement of
resi	stance	, induc	ctance	and ca	apacita	nce.						
۲ο υ 🖌	unders	tand t	he con	icept o	f the ti	ransdu	icer ar	nd the	eir effe	ective	ness in	converting
fron	n one	form	to the	e othe	r form	for t	he ea	se of	calc	ulatin	g and	measuring
pur	poses.				_					_		
۲٥ ۱	unders	tand t	he ope	rating	princip	oles of	basic	build	ling bl	ocks	of digit	al systems,
reco	ord and	d displa	ay unit	ts.								
Course Out	comes			4		4				-		
Upon su	icces	sful o	comp	let10	n of t	the c	ours	e, tr	ie st	uder	it wil	l be able
to:	1											
C01	Know	the co	onstru	ction a	nd wor	king o	f vario	us ty	pes of	analo	g instr	uments.
CO2	Desci	ribe the	e const	tructio	n and y	workin	g of wa	attme	eter ar	nd pov	ver fact	or meters
CO3	Know	the o	constru	action	and w	vorking	g vario	ous t	oridges	s for	the me	easurement
	resist	ance -	induc	tance a	and cap	pacitar	nce					
CO4	Know	the of	peratio	nal co	ncepts	of vari	ous tra	ansdı	lcers			
C05	Know	the co	onstru	ction o	f digita	1 mete	rs					
C06	Know	the of	peratio	n of di	gital m	eters						
Contribution $(1 - Low, 2)$	on of - Mediı	Cou um. 3 –	rse O High)	utcom	es to	wards	achie	eveme	ent o	of Pr	ogram	Outcomes
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
<u>C01</u>	3	2	1	1							1	
<u> </u>	3 3	3 3	1	1							1	
C04	3	3	1	1							1	
C05	3	3	1	-							1	
C06	3	3	1								1	
	1	-	1	1	1	1		1	I	I	1	I

UNIT I

Analog Ammeter and Voltmeters Classification – deflecting - control and damping torques - – PMMC - moving iron type and electrostatic instruments - Construction - Torque equation - Range extension - Errors and compensations - advantages and disadvantages. Instrument transformers: Current Transformer and Potential Transformer-construction theory - errors-Numerical Problems.

UNIT II

Analog Wattmeters and Power Factor Meters Electrodynamometer type wattmeter (LPF

and UPF) - Power factor meters: Dynamometer and M.I type (Single phase and Three phase) - Construction - theory - torque equation - advantages and disadvantages.

Potentiometers: Introduction to DC and AC Potentiometers – Construction-working – Applications - Numerical Problems.

UNIT III

Measurements of Electrical parameters

DC Bridges: Method of measuring low - medium and high resistance - sensitivity of Wheat stone's bridge - Kelvin's double bridge for measuring low resistance - Loss of charge method for measurement of high resistance - Megger – measurement of earth resistance - Numerical Problems.

AC Bridges: Measurement of inductance and quality factor - - Maxwell's bridge - - Hay's bridge - - Anderson's bridge. Measurement of capacitance and loss angle - - Desauty's bridge - Schering Bridge - Wien's bridge - Wagner's earthing device - - Numerical Problems.

UNIT IV

Transducers Definition - Classification - Resistive - Inductive and Capacitive Transducer - LVDT - Strain Gauge - Thermistors - Thermocouples - Piezo electric and Photo Diode Transducers - Hall effect sensorsNumerical Problems.

UNIT V

Digital meters Digital Voltmeters – Successive approximation DVM - Ramp type DVM and Integrating type DVM – Digital frequency meter - Digital multimeter - Digital tachometer -Digital Energy Meter - Q meter - Power Analyzer. CRO- measurement of phase difference & Frequency using lissajious patterns - Numerical Problems.

TEXT BOOKS:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C.Widdis - 5 th Edition - Wheeler Publishing.

2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper - PHI - 5 th Edition - 2002.

REFERENCE BOOKS:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications - 19th revised edition - 2011.

2. Electrical and Electronic Measurements and instrumentation by R.K.Rajput - S.Chand - 3 rd edition.

3. Electrical Measurements by Buckingham and Price - Prentice – Hall 4. Electrical Measurements by Forest K. Harris. John Wiley and Sons

POWER SYSTEM ANALYSIS

Lecture -	Tuto	rial:		3-1 Ho	ours		Int	erna	1 Mar	ks:		30
Credits:				3			Ext	erna	1 Maı	ks:		70
Course O	bjecti	ves:			<u> </u>							
To d	levelop	the in	npedar	nce dia	gram (p	p.u) ar	nd forn	natio	n of Ył	ous		
> To 1	earn tł	ne diffe	erent lo	ad flow	w meth	ods.						
> To	learn	the Zb	us bui	lding a	lgorith	m.						
➢ To	learn	short o	circuit	calcula	ation fo	r sym	metric	al fau	lts			
> To	learn t	he effe	ct of u	nsymn	netrical	l faults	s and t	heir e	effects	•		
≻ To	learn	the sta	bility o	of powe	er syste	ems ar	nd met	hod t	o imp	rove st	tability	
Course Out	comes		5	-	5				-		5	
Upon su	cces	sful c	comp	letio	n of t	he c	ours	e, tł	ie st	uden	t wil	l be able
<u>CO1</u>	Drow	imned	lance	liagra	n for a	nouve	r ovote	m ne	twork	and	colculo	te per unit
001	allan	tities		liagiai	.11 101 a	powe	i syste			anu	calcula	te per unit
<u> </u>	quan	$\frac{11000}{1000}$	od flor		ion to c		n arrat		ing di	fforom	t moth	
	Арріу	71		v solut		a powe						ous.
03	faults	ZDUS:	ior a p	ower s	ystem	netwo	rks an	a ana	uyse t	ne ene		ymmetrical
CO4	Find	the sec	quence	comp	onents	for po	wer sy	stem	Comp	onent	S	
CO5	Analy	se the	effects	s of un	symme	trical	faults.					
CO6	Analy	se the	stabili	ty con	cepts of	f a pov	wer sys	stem.				
Contributio	on of	Cou	rse O	utcom	es tov	vards	achie	eveme	ent o	f Pro	ogram	Outcomes
(1 - Low, 2	Mediu	1m, 3 –	High)					1				
	PO	PO	PO	PO	PO	PO	PO 7	PO	PO	PO 10	PO	PO
CO1	3	2	3	4	Э	O	1	0	9	10	1	14
C02	3	3	1	1							1	
CO3	3	3	1	1							1	
C04	3	3	1	1							1	
CO5	3	3	1								1	
CO6	3	3	1								1	

UNIT I

Circuit Topology & Per Unit Representation Graph theory definition – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Ybus matrix by singular transformation and direct inspection methods – Per Unit Quantities–Single line diagram – Impedance diagram of a power system – Numerical Problems.

UNIT II

Power Flow Studies Necessity of power flow studies – Derivation of static power flow equations – Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar coordinates form) – Decoupled and Fast Decoupled methods – Algorithmic approach – Numerical Problems on 3–bus system only.

UNIT III

Z-Bus Algorithm & Symmetrical Fault Analysis Formation of Zbus: Algorithm for the Modification of Zbus Matrix (without mutual impedance) – Numerical Problems.

Symmetrical Fault Analysis: Reactance's of Synchronous Machine – Three Phase Short Circuit Currents - Short circuit MVA calculations for Power Systems – Numerical Problems.

UNIT IV

Symmetrical Components Definition of symmetrical components – symmetrical components of unbalanced three phase systems – Power in symmetrical components – Sequence impedances and Sequence networks: Synchronous generator – Transmission line and transformers – Numerical Problems.

Unsymmetrical Fault analysis Various types of faults: LG– LL– LLG and LLL on unloaded alternator-Numerical problems.

UNIT V

Power System Stability Analysis Elementary concepts of Steady state – Dynamic and Transient Stabilities – Swing equation – Steady state stability – Equal area criterion of stability – Applications of Equal area criterion – Factors affecting transient stability – Methods to improve steady state and transient stability – Numerical problems.

TEXT BOOKS:

1. Power System Analysis by Grainger and Stevenson - Tata McGraw Hill.2003

2. Modern Power system Analysis – by I.J.Nagrath & D .P.Kothari: Tata McGraw-Hill Publishing Company - 3 rd edition - 2007.

REFERENCE BOOKS:

1. Power System Analysis – by A.R.Bergen - Prentice Hall - 2 nd edition - 2009.

2. Power System Analysis by HadiSaadat - Tata McGraw-Hill 3rd edition - 2010.

3. Power System Analysis by B.R.Gupta - A H Wheeler Publishing Company Limited - 1998.

4. Power System Analysis and Design by J.Duncan Glover - M.S.Sarma - T.J.Overbye - Cengage Learning publications - 5 th edition - 2011.

SIGNALS AND SYSTEMS (Professional Elective-II)

Lecture – Tutor	ial:	3-1 Ho	ours		Int	erna	1 Mar	ks:		30
Credits:		3			Ext	erna	l Mar	ks:		70
Course Objectiv	es:									
This gives t	he basics	of signa	ls and	syste	ms req	luireo	l for a	ll elec	trical e	engineering
related cour	rses.									
To underst	and the be	havior o	of signa	al in ti	me and	1 freq	uency	doma	ain.	
To understa	and the cha	aracteris	stics of	Linea	r Time	Inva	riant (LTI) s	ystems	
Concepts o	f the correl	lation a	nd sam	npling	proces	s.				
This give c	oncepts of	signals	and S	System	ıs alon	g wit	h its	analys	sis usir	ng different
transform●	techniques	s.								
Course Outcomes										
Upon success	ful com	pletio	n of t	he c	ourse	e, tł	ie st	uder	nt wil	l be able
to:										
CO1 Apply 1	the knowle	dge of v	arious	signal	s and	opera	ations.			
CO2 Analyz	e the spect	ral cha	racteris	stics o	f period	lic si	gnals	using	Fourie	r Analysis.
CO3 Classif	y the syste	ems bas	ed on	their p	propert	ies a	nd de	termir	ne the r	response of
LSI sys	stem using	convolu	ation.							
CO4 Unders	stand the p	orocess	of sam	pling a	and the	e effe	cts of 1	under	sampl	ing.
CO5 Apply 3	Laplace an	d z-tran	sforms	s to an	alyze s	ignal	s and	Syste	ms (coi	ntinuous).
CO6 Apply	Laplace an	d z-tran	sforms	s to an	alyze s	ignal	s and	Syste	ms (dis	screte).
Contribution of	Course (Outcom	es tov	wards	achie	veme	ent o	f Pro	ogram	Outcomes
PO	$\frac{11, 3 - High}{PO PO}$	PO	PO	PO	PO	PO	PO	PO	PO	PO
1	2 3	4	5	6	7	8	9	10	11	12
CO1 3	2								1	
CO2 3	$\frac{3}{2}$ 1	1							1	
CO3 3	$\frac{3}{2}$ 1	1							1	
CO5 3	$\frac{3}{2}$ 1	1							1	
CO6 3	$\frac{3}{3}$ 1								1	
	-			1		1	1	1	-	
			T	INIT	[
Introduction Defi	nition of	Signale	and S	vstem	- s - Cla	ssific	ation	of Sig	nale - (lassification
of Systems - Oper	ations on s	ignals: 1	time-sh	, stem	- time	-scali	ng - a	mpliti	ide-shi	fting -

of Systems - Operations on signals: time-shifting - time-scaling - amplitude-shifting amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals - Singularity functions and related functions: impulse function - step function signum function and ramp function. Analogy between vectors and signals - orthogonal signal space - Signal approximation using orthogonal functions - Mean square error - closed or complete set of orthogonal functions -Orthogonally in complex functions. Related Problems.

UNIT II

Fourier Series And Fourier Transform Fourier series representation of continuous time periodic signals - properties of Fourier series - Dirichlet's conditions - Trigonometric Fourier series and Exponential Fourier series - Relation between Trigonometric and Exponential Fourier series - Complex Fourier spectrum. Deriving Fourier transform from Fourier series -Fourier transform of arbitrary signal - Fourier transform of standard signals - Fourier transform of periodic signals - properties of Fourier transforms - Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform. Related Problems

UNIT III

Analysis of Linear Systems Introduction - Linear system - impulse response - Response of a linear system - Linear time invariant (LTI) system - Linear time variant (LTV) system -Concept of convolution in time domain and frequency domain - Graphical representation of convolution - Transfer function of a LTI system - Related problems. Filter characteristics of linear systems. Distortion less transmission through a system - Signal bandwidth - system bandwidth - Ideal LPF - HPF and BPF characteristics - Causality and PolyWiener criterion for physical realization - relationship between bandwidth and rise time.

UNIT IV

Correlation Auto-correlation and cross-correlation of functions - properties of correlation function - Energy density spectrum - Parseval's theorem - Power density spectrum - Relation between Convolution and correlation - Detection of periodic signals in the presence of noise by correlation - Extraction of signal from noise by filtering.

Sampling Theorem Graphical and analytical proof for Band Limited Signals - impulse sampling - Natural and Flat top Sampling - Reconstruction of signal from its samples effect of under sampling – Aliasing - Introduction to Band Pass sampling - Related problems.

UNIT V

Laplace Transforms Introduction - Concept of region of convergence (ROC) for Laplace transforms - constraints on ROC for various classes of signals - Properties of L.T's - Inverse Laplace transform - Relation between L.T's - and F.T. of a signal. Laplace transform of certain signals using waveform synthesis.

Z-Transforms Concept of Z- Transform of a discrete sequence. Region of convergence in Z-Transform - constraints on ROC for various classes of signals - Inverse Z-transform properties of Z-transforms. Distinction between Laplace - Fourier and Z transforms.

TEXT BOOKS:

1. Signals - Systems & Communications - B.P. Lathi - BS Publications - 2003.

2. Signals and Systems - A.V. Oppenheim - A.S. Willsky and S.H. Nawab - PHI - 2nd Edition1997 3. Signals & Systems - Simon Haykin and Van Veen - Wiley - 2nd Edition - 2007

REFERENCE BOOKS:

1. Principles of Linear Systems and Signals – BP Lathi - Oxford University Press – 2015

2. Signals and Systems - T K Rawat - Oxford University press - 2011.

ELECTRIC DRIVES (Professional Elective-II)

Lecture -	- Tuto	rial:		3-1 Ho	ours		Int	erna	1 Mar	ks:		30
Credits:				3			Ext	terna	1 Mai	ks:		70
Course O	bjecti	ves:										
➢ To 1	earn tł	ne fund	lamen	tals of	electric	c drive	and d	iffere	nt eleo	ctric b	raking	methods.
> To a	analyze	e the o	operati	on of	three p	hase	conver	ter c	ontrol	led do	motor	rs and four
qua	drant	operati	ion of a	dc mot	ors usi	ng dua	al conv	verter	s.			
> To	discus	s the I	DC-DC	conver	ter con	trol of	dc mo	otors.				
Το ι	unders	tand tl	he con	cept of	f speed	contro	ol of in	ducti	on mo	otor by	v using	AC voltage
con	trollers	s, volta	ge sou	rce inv	verters	and sl	ір роч	ver ree	covery	schei	me.	-
➢ To 1	earn tl	ne spee	ed cont	trol me	echanis	m of s	ynchro	onous	s moto	rs		
Course Out	tcomes	-										
Upon su	icces	sful o	comp	letio	n of t	the c	ours	e, th	ne st	uder	nt wil	l be able
to:			•					•				
C01	Expla	in the	e fund	lament	tals of	electr	ric dri	ve ai	nd di	ferent	elect	ric braking
	meth	ods.										0
CO2	Analy	ze the	opera	ation o	of three	e-phase	e conv	verter	fed d	lc mo	tors of	dc motors
	using	dual d	conver	ters.		I						
CO3	Analy	, ze the	e oper	ation	four a	uadrar	nt ope	ratio	ns of	dc m	otors	using dual
	conve	erters.	- 1		1		1.					8
CO4	Desci	ribe th	e DC-l	DC cor	nverter	fed co	ntrol	of dc	moto	rs in v	various	quadrants
	of ope	eration										1
CO5	Know	, the c	oncep	t of sr	beed co	ntrol	of ind	uctior	n mot	or by	using	AC voltage
	contr	ollers	and v	voltage	sourc	e inve	rters	and	differ	entiate	e the	stator side
	contr	ol and	rotor s	side co	ntrol							
CO6	Learr	the	concer	ots of	speed	contro	ol of s	svnch	ronou	s mo	tor wit	h different
	meth	ods.	1		-1			- 5				
Contributie	on of	Cou	rse O	utcom	es to	wards	achie	eveme	ent c	of Pro	ogram	Outcomes
(1 - Low, 2)	- Mediu	1m, 3 -	High)	1	T		-	1	1		-	1
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO 10
CO1	3	2	ও	4	5	6	1	8	9	10	1	12
C02	3	3	1	1							1	
CO3	3	3	1	1							1	
	-	3	1	1							1	
CO4	3											
CO4 CO5	3	3	1								1	
CO4 CO5 CO6	3 3 3	3	1 1								1	

Fundamentals of Electric Drives Electric drive and its components– Fundamental torque equation – Load torque components – Nature and classification of load torques – Steady state stability – Load equalization– Four quadrant operation of drive (hoist control) – Braking methods: Dynamic – Plugging – Regenerative methods.

UNIT II
Controlled Converter Fed DC Motor Drives 3-phase half and fully-controlled converter
fed separately and self-excited DC motor drive - Output voltage and current waveforms -
Speed-torque expressions - Speed-torque characteristics - Dual converter fed DC motor
drives -Numerical problems.
UNIT III
DC-DC Converters Fed DC Motor Drives Single quadrant, two quadrant and four
quadrant DC-DC converter fed separately excited and self-excited DC motors - Continuous
current mode of operation - Output voltage and current waveforms - Speed- torque
expressions and characteristics - Closed loop operation (qualitative treatment only).
UNIT IV
Stator and Rotor side control of 3-phase Induction motor Drive Stator voltage control
using 3-phase AC voltage regulators - Waveforms -Speed torque characteristics- Variable
Voltage Veriable Frequency control of induction motor by DWM voltage course inverter

Voltage Variable Frequency control of induction motor by PWM voltage source inverter – Closed loop V/f control of induction motor drives (qualitative treatment only). Static rotor resistance control - Slip power recovery schemes - Static Scherbius drive - Static Kramer drive – Performance and speed torque characteristics.

UNIT V

Control of Synchronous Motor Drives Separate control of synchronous motor - selfcontrol of synchronous motor employing load commutated thyristor inverter - closed loop control of synchronous motor drive (qualitative treatment only)- PMSM (Basic operation only).

TEXT BOOKS:

1. Fundamentals of Electric Drives - by G K Dubey - Narosa Publications - 2 nd edition -2002.

2. Power Semiconductor Drives - by S.B.Dewan - G.R.Slemon - A.Straughen - Wiley India -1984.

REFERENCE BOOKS:

1. Electric Motors and Drives Fundamentals - Types and Applications - by Austin Hughes and Bill Drury - Newnes.4th edition - 2013.

2. Thyristor Control of Electric drives - Vedam Subramanyam Tata McGraw Hill Publications - 1987. 3. Power Electronic Circuits - Devices and applications by M.H.Rashid - PHI - 3 rd edition - 2009.

ADVANCED CONTROL SYSTEMS (Professional Elective-II)

	ıre – T	utorial:		3-1 Hou	rs		Inte	erna	1 Mar	ks:		30			
Credi	ts:			3			Ext	erna	l Mar	ks:		70			
Cours	se Obj	ectives:													
\checkmark	To fan	niliarize t	he state	e space 1	represe	entat	ion in	cont	rollabi	le, obs	servabl	e, diagonal			
	and Jo	ordan can	onical	forms.											
\succ	Introd	luce the	concept	of contr	ollabil	lity a	nd obs	serval	bility 1	ests t	hrough	a canonical			
	forms	and desi	gn of s	state feed	lback	cont	roller 1	by po	ole pla	aceme	nt tech	inique and			
	State (Observer	design.												
\succ	Analy	lysis of a nonlinear system using describing function approach.													
\succ	Illustra	trate the Lypanov's method of stability analysis for linear and non-linear													
	contin	uous tim	e auton	omous sy	ystems	5.									
	Formu	lation of	Euler L	augrang	e equa	ation	for the	e opti	mizati	on of	typical	functional			
	and so	lutions.													
Course	e Outco	utcomes													
Upor	1 suce	cessful	comp	oletion	of th	ne c	ourse	e, tr	ie st	uden	it wil	be able			
to:															
CO1	A	nalyse di	fferent o	canonical	l forms	s - so	lution	of St	ate eq	uation	1.				
CO2	D	esign of	control	system	using	the	pole p	lacen	nent t	echnie	que is	given after			
	ir	itroducin	g the co	oncept of	contro	ollabi	lity and	d obs	servab	ility.					
CO3	A	nalyze no	onlinea	r system	usin	g de	scribin	g fu	nction	tech	nique	and phase			
	p	lane anal	ysis.												
CO4	E	xamine tl	ne stabi	ility analy	ysis us	sing I	yapun	lov m	lethod						
CO5	11	lustrate t	the Mir	nimization	n of fi	uncti	onal u	sing	calcu	lus of	variat	ion - state			
	p	roblems.													
C06		lustrate t	he Mini	mization	of fun	nction	al usir	ng qu	ladrati	c regu	ilator p	oroblems.			
Contri	bution	of Cou edium 3	urse C – High)	outcomes	towa	ards	achie	veme	ent o	i Pro	ogram	Outcomes			
1- 20	1	PO PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO			
		1 2	3	4	5	6	7	8	9	10	11	12			
CO		3 2									1				
~~~	2	3 3	1								1				
CO2	_		1 1	1 I I					1		1				
	1	3 3	1	1							1				
CO2 CO3 CO4	5 4 5	3 3 3 3	1	1							1				
(1 – Lo CO1	bucion bw, 2- M 1 1 2 2	edium, 3           PO         PO           1         2           3         2           3         3           3         3	- High) PO 3 1 1	PO 4 1 1 1	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11 1 1 1	PO 12			

## UNIT I

**State Space Analysis** State Space Representation – Canonical forms – Controllable canonical form – Observable canonical form - Jordan Canonical Form - Solution of state equation – State transition matrix.

# UNIT II

**Controllability** - Observability and Design of Pole Placement Tests for controllability and observability for continuous time systems – Time varying case – Minimum energy control – Time invariant case – Principle of duality – Controllability and observability form Jordan canonical form and other canonical forms – Effect of state feedback on controllability and observability – Design of state feedback control through pole placement.

#### UNIT III

**Nonlinear Systems** Introduction to nonlinear systems - Types of nonlinearities. Introduction to phase–plane analysis - Singular points; Describing function - basic concepts - Describing functions of non- linearities.

#### UNIT IV

**Stability analysis by Lyapunov Method** Stability in the sense of Lyapunov – Lyapunov's stability and Lyapunov's instability theorems – Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.

## UNIT V

**Calculus of Variations** Minimization of functional of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints –Euler lagrangine equation.

#### TEXT BOOKS:

Modern Control Engineering – by K. Ogata - Prentice Hall of India - 3rd edition - 1998.
 Automatic Control Systems by B.C. Kuo - Prentice Hall Publication.

#### **REFERENCE BOOKS:**

1. Modern Control System Theory – by M. Gopal - New Age International Publishers - 2nd edition - 1996

2. Control Systems Engineering by I.J. Nagarath and M.Gopal - New Age International (P) Ltd. 3. Digital Control and State Variable Methods – by M. Gopal - Tata Mc Graw–Hill Companies - 1997. 4. Systems and Control by Stainslaw H. Zak - Oxford Press - 2003. 5. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.

# SWITCH GEAR AND PROTECTION (Professional Elective-II)

Lecture ·	- Tuto	rial:		3-1 Ho	ours		Inte	erna	1 Mar	ks:		30
<b>Credits:</b>				3			Ext	erna	l Mar	ks:		70
Course C	)bjecti	ves:										
To provide the basic principles and operation of various types of circuit breakers.												
$\succ$ To know the classification, operation and application of different types of												
eleo	etromag	gnetic j	protect	tive rel	ays. T	`o expl	ain pro	otecti	ve sch	emes	for gen	nerator and
tra	nsform	ers.										
> To gain the knowledge of various protective schemes used for feeders and bus												
bar	bars.											
> To	explain	n the p	rincipl	e and	operati	ion of c	lifferen	it typ	es of s	static	relays.	
> To	o under	stand	differe	nt type	es of ov	ver volt	ages in	ı a p	ower s	ystem	and p	rinciples of
diff	erent n	leutral	groun	nding n	nethod	s.						
Course Ou	tcomes											
Upon su	icces	sful o	comp	letio	n of t	the c	ourse	e, tł	ie st	uden	it will	l be able
to:												
CO1	Illust	rate tł	ne prir	nciples	of ar	c inter	ruptio	n for	: appl	icatio	n to hi	igh voltage
	circui	it brea	kers of	air - c	oil - vac	cuum -	SF6 g	as ty	pe.			
CO2	Analy	vse th	ne wo	rking	princ	iple a	and o	perat	ion (	of di	fferent	types of
	electr	romagr	ietic pi	rotectiv	ve relay	/s.						
CO3	Acqui	ire kno	owledg	e of pr	otectiv	ve sche	emes fo	or ge	nerato	or and	l transf	formers for
	differ	ent fau	ilt cone	ditions	•							
CO4	Class	ify var	ious ty	pes of	protec	tive sc	hemes	used	l for fe	eders		
CO5	Class	ify var	ious ty	pes of	f prote	ctive s	cheme	s use	ed for	bus b	ar prot	ection and
	Types	s of sta	tic rela	ays.								
CO6	Analy	vse the	e opera	ation o	f differ	rent ty	pes of	over	volta	ges p	rotectiv	re schemes
	requi	red for	insula	ation co	o–ordir	nation	and typ	pes o	f neut	ral gro	ounding	g.
Contributi	on of	Cou	rse O	utcom	es to	wards	achie	veme	ent o	f Pro	ogram	Outcomes
1 - Low, 2	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2									1	
CO2	3	3	1	1							1	
CO3	3	3	1	1							1	
CO4	3	3		1		-					1	
CO5	3	3	1								1	
	3	3	L L								T	

#### UNIT I

**Circuit Breakers** Application oriented evolution of Switchgear - Miniature Circuit Breaker(MCB)– Elementary principles of arc interruption– Restriking Voltage and Recovery voltages– Restriking phenomenon - RRRV– Average and Max. RRRV– Current chopping and Resistance switching– Concept of oil circuit breakers– Description and operation of Air Blast– Vacuum and SF6 circuit breakers– Circuit Breaker ratings and specifications– Concept of Auto reclosing – Application Spectrum Numerical examples

## UNIT II

**Electromagnetic Protection** Relay connection – Balanced beam type attracted armature relay - induction disc and induction cup relays–Torque equation - Relays classification–Instantaneous– DMT and IDMT types– Applications of relays: Over current and under voltage relays– Directional relays– Differential relays and percentage differential relays–Universal torque equation– Distance relays: Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison.

### UNIT III

**Generator Protection** Protection of generators against stator faults– Rotor faults and abnormal conditions– restricted earth fault and inter turn fault protection– Numerical examples.

**Transformer Protection** Percentage differential protection– Design of CT's ratio– Buchholz relay protection–Numerical examples.

#### UNIT IV

**Feeder and Bus bar Protection & Static Relays**: Over current Protection schemes – PSM - TMS – Numerical examples – Carrier current and three zone distance relay using impedance relays.

**Protection of bus bars by using Differential protection**. Static relays: Introduction – Classification of Static Relays – Basic Components of Static Relays.

## UNIT V

**Protection against over voltage and grounding** Generation of over voltages in power systems– Protection against lightning over voltages– Valve type and zinc oxide lighting arresters.

Grounded and ungrounded neutral systems – Effects of ungrounded neutral on system performance – Methods of neutral grounding: Solid-resistance-Reactance-Arcing grounds and grounding Practices.

### TEXT BOOKS:

1. Power System Protection and Switchgear by Badri Ram and D.N Viswakarma - Tata McGraw Hill Publications - 2 nd edition - 2011.

2. Power system protection- Static Relays with microprocessor applications by T.S.Madhava Rao - Tata McGraw Hill - 2 nd edition.

## **REFERENCE BOOKS:**

1. Fundamentals of Power System Protection by Paithankar and S.R.Bhide. - PHI - 2003.

2. Art & Science of Protective Relaying - by C R Mason - Wiley Eastern Ltd.

3. Protection and SwitchGear by BhaveshBhalja - R.P. Maheshwari - Nilesh G.Chothani - Oxford University Press - 2013.

# BIG DATA ANALYTICS (Professional Elective-II)

Lecture -	Tuto	rial:		3-1 Ho	ours		Inte	erna	1 Mar	ks:		30
Credits:				3			Ext	erna	1 Mar	ks:		70
Course O	bjecti	ves:										
To understand the competitive advantages of big data analytics												
To understand the big data frameworks												
To learn data analysis methods												
> To	learn s	stream	compi	ıting								
> To	gain k	nowled	lge on	Hadoo	op relat	ted to	ols suc	ch as	HBas	se, Ca	ssandr	a, Pig, and
Hive	e for bi	g data	analyt	ics								
Course Out	comes											
Upon successful completion of the course, the student will be able												
to:												
CO1	Understand how to leverage the insights from big data analytics											
CO2	Analy	ze data	a by ut	ilizing	various	s stati	stical a	appro	aches			
CO3	Analy	ze data	a by ut	ilizing	various	s data	minin	g app	oroach	es		
CO4	perfor	rm ana	lytics	on real	l-time s	stream	ing da	ta				
CO5	Unde	rstand	the va	rious l	NoSql a	lterna	tive da	ataba	se mo	dels		
CO6	To ga	in kno	wledge	e on H	ladoop	relate	d tools	s suc	h as l	HBase	, Cass	andra, Pig,
	and H	live for	big da	ata ana	alytics							
Contributio	on of	Cou	rse O	utcom	es tov	vards	achie	veme	ent o	f Pro	ogram	Outcomes
(1 - Low, 2)	- Mediu	<u>1m, 3 –</u>	High)	DO	DO		DO	<b>DO</b>	DO	DO	PO	PO
	PO 1	2	3	PO 4	P0 5	P0	P0 7	8	90 9	PO 10	PO 11	PO 12
CO1	3	2	- <b>-</b>	•	•		-	- <b>U</b>		10	1	
CO2	3	3	1	1							1	
CO3	3	3	1	1							1	
CO4	3	3	1	1							1	
CO5	3	3	1								1	
C06	3	3	1								1	

UNIT I

**Introduction To Big Data** Big Data, Definition, Characteristic Features, Big Data Applications, Big Data vs Traditional Data, Risks of Big Data, Structure of Big Data, Challenges of Conventional Systems, Web Data, Evolution of Analytic Scalability.

### UNIT II

**Hadoop Framework** Distributed File Systems, Large-Scale File System Organization, HDFS concepts, Map Reduce Execution, Algorithms using Map Reduce, Hadoop YARN.

## UNIT III

Data Analysis Statistical Methods: Regression modelling, Multivariate Analysis,

Classification: SVM & Kernel Methods, Rule Mining, Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Predictive Analytics, Data analysis using R.

## UNIT IV

**Mining Data Streams Streams:** Concepts, Stream Data Model and Architecture, Sampling data in a stream, Mining Data Streams and Mining Time-series data, Real Time Analytics Platform (RTAP) Applications, Case Studies, Real Time Sentiment Analysis.

## UNIT V

**Big Data Frameworks** Introduction to NoSQL, Aggregate Data Models, Hbase: Data Model and Implementations, Hbase Clients, Examples, Cassandra: Data Model, Examples, Cassandra Clients, Hadoop Integration.

#### **TEXT BOOKS:**

1. Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC

2. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly

3. Hadoop in Action by Chuck Lam, MANNING Publ.

## **REFERENCE BOOKS:**

1. Hadoop in Practice by Alex Holmes, MANNING Publ.

2. Hadoop MapReduce Cookbook, SrinathPerera, ThilinaGunarathne

3. Michael Berthold, David J. Hand, --Intelligent Data Analysis^I, Springer, Second Edition, 2007.

4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley

# BATTERY MANAGEMENT SYSTEMS AND CHARGING STATIONS (Open Elective-II)

Lecture -	Tuto	rial:		3-1 Ho	ours		Inte	erna	1 Mar	ks:		30
Credits:			3	3			Ext	erna	1 Mar	ks:		70
Course O	bjecti	ves:										
> Able	Able to understand the working of different batteries for EV applications											
> Able	e to kn	ow the	funda	menta	ls of ba	attery o	chargir	ng me	ethods	and t	heir ad	vantages
Able to know the different kinds of equipment in charging station												
> Able	e to kn	ow the	requir	rement	s of ba	ttery n	nanage	emen	t.			
> Able	e to kn	ow me	thod of	f mode	lling ba	atterie	s and t	heir	simula	ation s	studies	
Course Out	comes											
Upon su	Icces	sful o	comp	letio	n of t	the c	ourse	e, th	ne st	uden	it will	l be able
to:												
CO1	<b>CO1</b> Describe the construction of different batteries for EV applications											
CO2	Describe the operation of different batteries for EV applications											
CO3	Describe charging algorithms of different batteries and balancing methods of											
	batter	ry pacl	ζS									
CO4	Desci	ribe the	e differ	ent kir	nds of i	nfrast	ructure	e nee	ded in	the c	harging	g stations
CO5	Desci	ribe the	e requi	remen	ts of ba	attery	manag	emen	it and	their	mainte	nance.
CO6	Obtai	n the 1	nodelli	ing of l	oatterie	es and	develo	p the	ir sim	ulatio	n mode	els.
Contributio	on of	Cou	rse O	utcom	es to	wards	achie	veme	ent o	f Pro	ogram	Outcomes
(1 - Low, 2)	- Mediu	1 <u>m, 3 –</u>	High)	DO	DO	DO	DO	PO	DO	DO	DO	PO
	1	2	3	P0 4	P0 5	6	P0 7	8	9 9	PO 10	PO 11	PO 12
CO1	3	2					-				1	
CO2	3	3	1	1							1	
CO3	3	3	1	1							1	
CO4	3	3	1	1							1	
C05	3	3	1								1	
C06	3	3	1								1	

UNIT I

**EV Batteries** Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel. Lead Acid Batteries: Lead acid battery basics, special characteristics of lead acid batteries, battery life and maintenance, Li-ion batteries. Nickel-based Batteries: Nickel cadmium, Nickel metal hydride batteries.

**Sodium-Based Batteries:** Introduction, sodium sulphur batteries, sodium metal chloride (Zebra) batteries. Lithium Batteries: Introduction, the lithium polymer battery, lithium ion battery.

### UNIT II

**Battery charging strategies** Charging algorithms for a single battery: Basic terms for charging performance evaluation and characterization, CC charging for NiCd/NiMH

batteries, CV charging for lead acid batteries, CC/CV charging for lead acid and Li-ion batteries, MSCC charging for lead acid, NiMH and Li-ion batteries, TSCC/CV charging for Li-ion batteries, CVCC/CV charging for Li-ion batteries, Pulse charging for lead acid, NiCd/NiMH and Li-ion batteries, Charging termination techniques, Comparisons of charging algorithms and new development; Balancing methods for battery pack charging: Battery sorting Overcharge for balancing, Passive balancing, Active balancing.

#### UNIT III

**Charging Infrastructure** Domestic Charging Infrastructure, Public charging Infrastructure, Normal Charging Station, Occasional Charging Station, Fast Charging Station, Battery Swapping Station, Move-and-charge zone.

#### UNIT IV

**Battery-Management-System Requirements** Battery-pack topology, BMS design requirements, Voltage sense, Temperature sense, Current sense, Contactor control, Isolation sense, Thermal control, Protection, Charger control, Communication via CAN bus, Log book, SOC estimation, Energy estimation, Power estimation, Diagnostics .

### UNIT V

**Battery Modelling** General approach to modelling batteries, simulation model of rechargeable Li-ion battery, simulation model of a rechargeable NiCd battery, Parameterization of NiCd battery model, Simulation examples.

#### TEXT BOOKS:

1. Electric Vehicles Technology Explained by James Larminie Oxford Brookes University, Oxford, UK John Lowry Acenti Designs Ltd., Uk. (Unit-1)

2. Energy Systems for Electric and Hybrid Vehicles by K.T. Chau, IET Publications, First edition, 2016. (Unit-2)

## **REFERENCE BOOKS:**

1. Modern Electric Vehicles Technology by C.C.Chan, K.T Chau, Oxford University Press Inc., New york , 2001. (Unit-3)

2. Battery Management Systems Vol. – II Equivalent Circuits and Methods, by Gregory L.Plett, Artech House publisher, First edition 2016. (Unit-4)

3. Battery Management Systems: design by Modelling by Henk Jan Bergveld, Wanda S. Kruijt, Springer Science & Business Media, 2002. (Unit-5)

# FUNDAMENTALS OF UTILIZATION OF ELECTRICAL ENERGY (Open Elective-II)

Lecture – Tutorial:	3-1 Ho	ours		Int	erna	1 Mar	ks:		30		
Credits:	3			Ext	erna	1 Maı	ks:		70		
Course Objectives:											
$\succ$ To study the var	rious typ	bes of	Illun	ninatio	n e	quipm	ent,	measu	rement of		
Illumination, Illumir	nation tec	hnique	s.								
> To know the various technologies used for heating applications using electrical											
energy.											
> To understand the various welding techniques and operations of welding											
equipment and com	parison.										
To know the various	systems	of trac	tion, e	quipm	ent u	sed fo	r tract	tion.			
> To understand the	importan	ce and	l opera	ation o	of var	ious l	Energy	v stora	ge systems		
and comparison & a	pplicatior	18.									
Course Outcomes		•	. 4			-	•				
Upon successful completion of the course, the student will be able											
to:											
CO1 Know the conce	pts of illu	iminat	ion								
CO2 Know the conce	X02 Know the concepts of various illumination methods.										
CO3 Know about the	e resistan	ce - ind	duction	n and o	lielec	tric h	eating	•			
CO4 Learn about the	e resistan	ce and	arc w	elding	and v	veldin	g equi	pment			
CO5 Know about the	e mechan	isms -	equip	ment a	ind to	echnol	logy u	sed in	the electric		
traction.											
CO6 Differentiate the	e importa	nce of	variou	s energ	gy sto	orage s	systen	ıs			
Contribution of Course (1 - Low, 2- Medium, 3 - High	Outcom	es to	wards	achie	veme	ent o	of Pro	ogram	Outcomes		
PO PO PO	D PO	PO	PO	PO	PO	PO	PO	PO	PO		
	6 4	5	6	7	8	9	10	11	12		
								1			
	1							1			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$								1			
CO5 3 3 1								1			
CO6 3 3 1					<u> </u>			1			
	<u> </u>	1	UNIT	[	I	I	I	_	l		
Illumination fundamenta	<b>s</b> Introdu	iction -	terms	- used	in illı	ımina	tion_I	aws of	,		
illumination Lux meter So	urces of 1	ight		asea							

**Various Illumination Methods** Tungsten filament lamps and fluorescent lamps -Comparison –Basic principles of light control– Types and design of lighting and flood lighting–LED lighting - Energy conservation.

## UNIT II

**Electric Heating** Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating.

# UNIT III

**Electric Welding** Electric welding–Resistance and arc welding–Electric welding equipment– Comparison between AC and DC Welding

## UNIT IV

**Electric Traction** System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor– Mechanics of train movement–Speed–time curves for different services – Trapezoidal and quadrilateral speed time curves. Calculations of tractive effort– power – Specific energy consumption for given run–Effect of varying acceleration and braking retardation– Adhesive weight and braking retardation adhesive weight and coefficient of adhesion.

## UNIT V

**Introduction to Energy Storage Systems** Need for energy storage - Types of energy storage-Thermal - electrical - magnetic and chemical storage systems - Comparison of energy storage technologies-Applications.

## TEXT BOOKS:

1. Electrical Power Systems(Generation, Transmission, Distribution, Protecection and Utilization of Electrical Energy) – Dr. S.L.Uppal and Prof. Sunil S.Rao – Khanna Publisher, 15th edition, 1987.

2. Electric Power Distribution – A S Pabla – McGrawHill.

## **REFERENCE BOOKS:**

1. Generation Distribution and Utilization of Electrical Energy – C.L.Wadhwa-New Age International Publishers- revised third edition.

# INDIAN ELECTRICITY ACT (Open Elective-II)

Lecture -	Tuto	rial:	3	3-1 Hc	ours		Inte	erna	1 Mar	ks:		30
Credits:				3			Ext	erna	1 Mar	ks:		70
Course O	Course Objectives:											
$\succ$ To acquire knowledge on national policy, plan and joint responsibilities of state												
and central governments.												
> To	$\succ$ To understand the licensing procedures in transmission and distribution											
companies.												
➤ To 1	earn tł	ne regu	latory	body r	ules a	nd pro	tocols.					
> To 1	unders	tand t	he offe	ences a	and pe	enalties	s relate	ed iss	sues w	vith re	espect 1	to different
trib	unals.											
> To	learn t	he lega	al relat	ed issu	ies and	d their	resolu	tions	•			
Course Out	comes					-						
Upon successful completion of the course, the student will be able												
to:												
CO1	Learn	the n	ationa	l policy	y and	plan a	nd the	join	t resp	onsibi	lities of	f state and
	centr	al gove	rnmen	its								
CO2	Analy	ze the	e licer	nsing	and t	the pr	ovisior	is re	elated	to t	ransmi	ssion and
	distri	bution	of elec	etricity	•							
CO3	Reme	mber t	the con	npositi	on and	d powe	rs of R	egula	tory c	ommi	ssions	and CEA.
CO4	Learn	the fu	Inction	is of Ap	opellat	e Tribu	inal for	c elec	tricity			
CO5	Know	the co	onstitu	tion pr	rocedu	re in S	pecial	court	s and	dispu	te reso	lutions.
C06	Know	the co	onstitu	tion pr	ovisio	ns in S	pecial	court	ts and	dispu	ite reso	lutions.
Contributio	on of Mediu	Coui	rse O	utcom	es to	wards	achie	veme	ent o	f Pro	ogram	Outcomes
(1 – Low, 2	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2									1	
C02	3	3	1	1		_					1	
CO3	3	3	1	1							1	
C04 C05	3	3	1	1							1	
C05	3	3	1								1	
			-								-	

### UNIT I

**National Electricity Policy and Plan** - **Generation of Electricity** Electricity Act: commencement - definitions - comments; national policy on standalone systems nonconventional energy systems - electrification and local distribution for rural areas; joint responsibilities of state and central governments in rural electrification - requirement for setting up of generating station - hydro-electric generation - captive generation; duties of generating companies.

## UNIT II

**Licensing -Transmission and Distribution Of Electricity** Licensing: powers - procedures - conditions - amendments - revocation - provisions - directions - suspension and sale; inter-state and intra-state transmission; other provisions relating to transmission; provisions with respect to distribution licenses - electricity traders - supply generally; consumer protection: standard performance. Electrical Wiring, Estimation & Costing

#### UNIT III

**Tariff - CEA and Regulatory Commissions** Works of licenses - provisions relating to overhead lines; Constitution and functions of Central Electricity Authority (CEA) - directions and certain powers; Constitution - powers and functions of state and central commissions - other provisions - proceedings and powers of Appropriate commission - Grants - Fund - Accounts Audit and Report

#### UNIT IV

**Appellate Tribunal - Reorganisation of Boards - Offences and Penalty** Appellate Tribunal for electricity; investigation and assessment; reorganisation of boards; Offences and penalties.

## UNIT V

**Special Courts - Dispute Resolution - Other Provisions and Miscellaneous** Constitution of special courts - procedures - powers - appeal - revision; arbitration; protective clauses; miscellaneous and enactments.

## TEXT BOOKS:

1. The Electricity Act - 2003 {Act 36 of 2003 - dt.2-6-2003 - w.e.f. 10-6-2003 vide S.O. No. 669(E) - dt. 10-6-2003] published by Commercial Law Publishers (I) Pvt. Ltd.

## **REFERENCE BOOKS:**

1. The Electricity Act - 2003 {Act 36 of 2003 - dt.2-6-2003 - w.e.f. 10-6-2003 vide S.O. No. 669(E) - dt. 10-6-2003] published by Commercial Law Publishers (I) Pvt. Ltd.

## ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LAB

Lecture – Tutorial:	3-0 Hours	Internal Marks:	15	
Credits:	1.5	<b>External Marks:</b>	35	
<b>Course Objectives:</b>				
To understand studer	its how differe	nt types of meters work and their con	nstruction.	
To make the studen capacitance by AC & 1	ts understand DC bridges.	how to measure resistance, induc	ctance and	
$\succ$ To understand the test	ting of CT and	l PT.		
<ul> <li>to Understand and transducer, piezoelect</li> <li>To understand the m</li> </ul>	the character ric transducer easurement of	ristics of Thermo couples, LVDT, Strain and choke coil parameters.	Capacitive	

> To study the procedure for standardization and calibration of various methods.

### List of Experiments

### (Any 10 of the following experiments are to be conducted)

- 1. Calibration of dynamometer wattmeter using phantom loading
- 2. Measurement of resistance using Kelvin's double Bridge and Determination of its tolerance.
- 3. Measurement of Capacitance using Schering Bridge.
- 4. Measurement of Inductance using Anderson Bridge.
- 5. Calibration of LPF Wattmeter by direct loading.
- Measurement of 3 phase reactive power using single wattmeter method for a balanced load.
- 7. Testing of C.T. using mutual inductor Measurement of % ratio error and phase angle of given C.T. by Null deflection method.
- P.T. testing by comparison V.G as Null detector Measurement of % ratio error and phase angle of the given P.T.
- 9. Determination of the characteristics of a Thermocouple.
- 10. Determination of the characteristics of a LVDT.
- 11. Determination of the characteristics for a capacitive transducer.
- 12. Measurement of strain for a bridge strain gauge.

- 13. Measurement of Choke coil parameters and single phase power using three voltmeter and three ammeter methods.
- 14. Calibration of single phase Energy Meter.
- 15. Dielectric oil Test using HV Kit.
- 16. Calibration of DC ammeter and voltmeter using Crompton DC Potentiometer.
- 17. AC Potentiometer: Polar Form / Cartesian Form Calibration of AC voltmeter Parameters of choke.

## MICROPROCESSORS AND MICROCONTROLLERS LAB

Lecture – Tutorial:	3-0 Hours	Internal Marks:	15
Credits:	1.5	External Marks:	35
Course Objectives:			

> To study programming based on 8086 microprocessor and 8051 microcontroller.

- To study 8086 microprocessor based ALP using arithmetic, logical and shift operations.
- > To study to interface 8086 with I/O and other devices.
- > To study parallel and serial communication using 8051& PIC 18 micro controllers.

## List of Experiments

## (Any 10 of the following experiments are to be conducted)

8086 Microprocessor Programs:

1. Arithmetic operations – Two 16-bit numbers and multibyte addition - subtraction - multiplication and division – Signed and unsigned arithmetic operations - ASCII – Arithmetic operations.

2. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD - BCD to ASCII conversion.

3. Arrange the given array in ascending and descending order 4. Determine the factorial of a given number

5. By using string operation and Instruction prefix: Move block - Reverse string Sorting - Inserting - Deleting - Length of the string - String comparison. 6. Find the first and nth number of 'n' natural numbers of a Fibonacci series.

7. Find the number and sum of even and odd numbers of a given array

8. Find the sum of 'n' natural numbers and squares of 'n' natural numbers

9. Arithmetic operations on 8051

10. Conversion of decimal number to hexa equivalent and hexa equivalent to decimal number

11. Find the Sum of elements in an array and also identify the largest & smallest number of a given array using 8051.

Programs on Interfacing:

12. Interfacing 8255–PPI with 8086.

13. Stepper motor control using 8253/8255.

- 14. Reading and Writing on a parallel port using 8051
- 15. Timer in different modes using 8051
- 16. Serial communication implementation using 8051
- 17. Understanding three memory areas of 00 FF Using 8051 external interrupts.
- 18. Traffic Light Controller using 8051.

## POWER SYSTEMS AND SIMULATION LAB

Lecture – Tutorial:	3-0 Hours	Internal Marks:	15						
Credits:	1.5	External Marks:	35						
Course Objectives:									
To study programmi	ng based on 80	86 microprocessor and 8051 microco	ontroller.						
To study 8086 mid operations.	croprocessor ba	ased ALP using arithmetic, logical	and shift						
To study to interface	e 8086 with I/C	) and other devices.							

> To study parallel and serial communication using 8051& PIC 18 micro controllers.

### List of Experiments

Any of 5 experiments are to be conducted from each section:

Section I: Power Systems Lab:

1. Estimation of sequence impedances of 3-phase Transformer

2. Estimation of sequence impedances of 3-phase Alternator by Fault Analysis 3. Estimation of sequence impedances of 3-phase Alternator by Direct method

4. Estimation of ABCD parameters on transmission line model

5. Performance of long transmission line without compensation

6. Performance of long transmission line with shunt compensation

7. Analyze the Ferranti effect on long transmission line Section II: Simulation Lab

8.Determi nation of Ybus using direct inspection method

9.Load flow solution of a power system network using Gauss-Seidel method

10. Load flow solution of a power system network using Newton Raphson method.

11. Formation of Zbus by building algorithm.

12. Economic load dispatch with & without losses

13. Load frequency control of a two area Power System without & with PI controller

14. Transient Stability analysis of single machine connected to an infinite bus (SMIB) using equal area criterion.

#### SKILL ADVANCED COURSE: MACHINE LEARNING WITH PYTHON

Lecture – Tutorial:	3-0 Hours	Internal Marks:	15						
Credits:	2	External Marks:	35						
Course Objectives:									
> This course will enable students to learn and understand different Data sets in									
implementing the i	nachine learning	g algorithms.							

Requirements: Develop the following program using Anaconda/ Jupiter/ Spider and evaluate ML models.

#### LIST OF EXPERIMENTS

1) Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2) For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3) Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4) Exercises to solve the real-world problems using the following machine learning methods: a) Linear Regression b) Logistic Regression c) Binary Classifier

5) Develop a program for Bias, Variance, Remove duplicates, Cross Validation

6) Write a program to implement Categorical Encoding, One-hot Encoding

7) Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

8)Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

9) Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

10)Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

11)Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

12) Exploratory Data Analysis for Classification using Pandas or Matplotlib.

13) Write a Python program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set

14) Write a program to Implement Support Vector Machines and Principle Component Analysis

15) Write a program to Implement Principle Component Analysis

## **RESEARCH METHODOLOGY**

Lecture -	Tuto	rial:		2-1 Ho	ours		Int	erna	1 Mar	ks:		30
<b>Credits:</b>			(	)			Ext	erna	l Mar	ks:		70
Course O	bjecti	ves:										
> Το ι	unders	tand tl	ne obje	ctives	and ch	aracte	ristics	ofa	resear	ch pro	oblem.	
> To a	analyze	e resea	rch rel	ated in	ıformat	ion ar	nd to fo	llow	resear	ch eth	nics	
To understand the types of intellectual property rights.												
➤ To 1	earn a	bout tł	ne scop	be of pa	atent ri	ghts.						
≽ Το ι	unders	tand tł	ne new	develo	opment	s in IF	PR.					
Course Out	comes											
Upon successful completion of the course, the student will be able												
to:	to:											
CO1	Unde	rstand	object	ives of	a resea	arch p	roblem	1				
CO2	Understand characteristics of a research problem											
CO3	Analy	ze rese	earch r	elated	inform	ation	and to	follow	w rese	arch e	ethics.	
CO4	Unde	rstand	the ty	pes of	intellec	ctual p	ropert	y righ	nts.			
CO5	Learn	about	t the so	cope of	IPR.							
CO6	Unde	rstand	the ne	ew dev	elopme	nts in	IPR.					
Contributio	on of	Cou	rse O	utcom	es tov	vards	achie	veme	ent o	f Pro	ogram	Outcomes
(1 - Low, 2)		$\frac{1m}{PO}$	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2									1	
CO2	3	3	1	1							1	
CO3	3	3	1	1							1	
CO4	3	3	1	1							1	
CO5	3	3	1								1	
CO6	3	3	1								1	

#### UNIT I

**Research problem:** Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

#### UNIT II

**Literature study:** Effective literature studies approaches, analysis Plagiarism, Research ethics, Technical writing: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

#### UNIT III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright.
**Process of Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

### UNIT IV

**Patent Rights:** Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

### UNIT V

**New Developments in IPR:** Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc, Traditional knowledge Case Studies, IPR and IITs.

### **TEXT BOOKS:**

ext Books: 1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"

2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

### **REFERENCE BOOKS:**

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

2. Mayall, "Industrial Design", McGraw Hill, 1992.

3. Niebel, "Product Design", McGraw Hill, 1974.

4. Asimov, "Introduction to Design", Prentice Hall, 1962.

5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

6. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

#### DIGITAL CONTROL SYSTEMS (Honors Engineering Course)

Lecture – T	ſutoria	al:		3-1 Hou	urs		Int	erna	l Marl	KS:		30		
Credits:				3			Ext	terna	l Mar	ks:		70		
Course Ob	jective	es:												
<ul> <li>To unc compor</li> <li>The the digital of</li> <li>To repr transiti method</li> <li>To exan method</li> </ul>	lerstan nents as cory of control esent t on ma .", desi nine th	d the ssociate z-tran system the disc trix, th gn of st e stabil lyzing o	conce edwith nsform ns. crete-t ne des cate obs lity of t digital	pts of it. Adv ations ime sy ign of servers he syst control	digita antage and aj stems i state state s tem usi	nl com s comp oplicat n state feedba ng diff ns in th	trol sy pared to ion for e-space ack co erent t	vstem o the o the e moo ntrol ests a ane.	s and analog math del and by "f	l asse ; type. ematic d evalu the po idy the	emble v cal anal uation o ole plao e conve	various ysis of of state cement ntional		
Design	of state	feedba	ick con	troller	throug	h pole	placem	ient.						
Linon and		ul cor	nnlati	ion of	the		that	tud.	ont		abla			
Opon suc	cessi	Illustrate advantages of digital systems, sampling and data reconstruction.												
01	Illustrate advantages of digital systems, sampling and data reconstruction.													
CO2	Calculate Z Transform and Inverse Z Transfer function, pulse transfer functions of open andclosed loop response.													
CO3	Const obser	ruct v vability	/arious /.	cano	onical	forms	and	cond	cepts	of c	ontrolla	bility and		
CO4	Comp Stabil	ute the	e absol erion a	ute and nd Roo	d relati t Locus	ve stal	oility o	f disc	rete ti	me sy	stems ı	ising Routh		
C05	Desig diagra	n lag ai ams.	nd lead	compe	ensator	s to im	prove	syste	m perf	orman	nce usin	g bode		
CO6	Desig	n of sta	te feed	back c	ontrolle	ers and	l state o	bser	vers.					
Contribution (1 - Low, 2-	n of <u>Medium</u>	Cour 1, 3 – Hig	se C (h)	utcome	es tov	wards	achie	veme	nt o	of Pi	rogram	Outcomes		
	P0	PO 2	P0 2	PO	PO F	P0	PO 7	PO o	PO	PO	PO	PO		
CO1	1	<u> </u>	3	4	5	U		0	7	10	11	14		
C02														
C03														
<b>CO4</b>						1								
CO5														
C06						1								
					]	UNIT I								

### Introduction to Signal Processing

Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Continuous and Discrete Time Signals – Sample and hold devices – Sampling theorem and data reconstruction – Frequency domain characteristics of zero order hold.

#### **UNIT II**

### **Z**-Transformations

Z–Transforms – Theorems – Finding inverse Z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.

### **UNIT III**

### State Space Analysis and the Concepts of Controllability and Observability

State space representation of discrete time systems – Solving Discrete Time state space equations – State transition matrix and its properties – Discretization of continuous time state equations – Concepts of controllability and observability – Tests(without proof).

#### **UNIT IV**

### Stability Analysis

Mapping between the S–Plane and the Z–Plane – Primary strips and Complementary strips – Stabilitycriterion – Modified Routh's stability criterion and Jury's stability test. **Design of Discrete–Time Control Systems By Conventional Methods** 

Transient and steady state specifications – Design using frequency response in the w– plane for lag andlead compensators – Root locus technique in the z–plane.

### UNIT V

### State Feedback Controllers and State Observers

Design of state feedback controller through pole placement – Necessary and sufficient conditions –Ackerman's formula – Design of state observers (Full Order and Reduced Order).

### **TEXT BOOKS:**

1. Discrete–Time Control systems – K. Ogata - Pearson Education/PHI - 2nd Edition. 2. Digital Control and State Variable Methods by M.Gopal - TMH - 4th Edition.

#### **REFERENCE BOOKS:**

1. Digital Control Systems - Kuo - Oxford University Press - 2nd Edition - 2003.

# ANALYSIS OF POWER ELECTRONIC CONVERTERS

(Honors Engineering Course)

Lecture – T	Futoria	al:	2	3-1 Hou	ırs	0	Int	erna	l Marl	KS:		30		
Credits:				3			Ext	erna	l Marl	KS:		70		
Course Ob	iective	es:		,			211					7.0		
To learn	n the ch	aracte	ristics	ofswit	ching d	evices	& funct	tiona	lityof	vate di	rive ciro	ruits		
To illus	trate th	e work	ring of	AC-DC	convert	ters	a rune	ciona	incy of a	Succ ui		cuito.		
<ul> <li>To lear</li> </ul>	n funct	tionalit	vofPW	/M inve	erters in	n contr	olling t	he vo	ltage :	and m	itioatin	o the		
harmon	nics	lonung	y 011 V			ii conti	oning (	ine ve	nuge		inguing	Stile		
To unde	erstand	the ha	sic con	cents c	f multi-	-level i	nvertei	22						
<ul> <li>To learn</li> </ul>	n PWM	contro	lofCH	R and c	liode cl:	amned	multi-	level	invert	ers				
Course Outc	omes	contro		b and t	noue en	ampeu	munti		mvert	015				
Upon suc	rcessf	ul con	nnleti	ion of	the co	nirse	the s	tud	ent w	ill he	able	to:		
CO1	Descr	ihe and	lanaly	ze the c	haracte	oristice	s of Swi	tchin	σ devi			.01		
600	DUSCI	Demonstrate the operation and perform harmonic analysis of AC-DC power												
CO2	Demo	enstrate	e the op	peratio	n and p	erform	i harmo	onic a	inalysi	s of A(	L-DC po	wer		
602	conve	converters												
03	Analy	ze the o	operati	on of s	ingle-pl	hase ai	nd thre	e-pha	ase inv	erters	with P	WM		
	contro	ol.												
CO4	Illustr	rate the	princi	ples of	operati	ion of 1	nultile	vel in	verter	S				
C05	PWM	Contro	l of CH	B mult	ilevel in	verter	S							
CO6	PWM	Contro	l of dio	de clar	nped m	ultilev	el inve	rters				-		
Contribution	1 Of	Cour	se O	utcome	es tov	vards	achie	veme	nt o	f Pr	rogram	Outcomes		
(1 - L0W, 2 - 1)	PO	, з – ні <u>е</u> РО	PO	PO	РО	РО	РО	PO	РО	PO	PO	РО		
	1	2	3	4	5	6	7	8	9	10	11	12		
C01														
CO2														
CO3														
CO4														
CO5														
CO6														

#### UNIT I

#### **Overview of Switching Devices**

Power MOSFET, IGBT, GTO -static and dynamic characteristics, gate drive circuits for switching devices.

#### UNIT II

### AC-DC Converters

Single-phase fully-controlled converters with RL load– Continuous and Discontinuous load current operation-Evaluation of input power factor and harmonic factor Power factor improvements using extinction angle control, symmetrical angle control, PWM control. Three-Phase AC-DC fully-controlled Converters with RL load- Continuous and Discontinuous load current operation-Evaluation of input power factor and harmonic factor -three-phase dual converters.

#### UNIT III

### **PWM Inverters**

Operation of single-phase inverters -Voltage control of single-phase inverters - phase displacement Control –Bipolar PWM – Unipolar PWM- staircase PWM. Voltage Control of Three-Phase Inverters- Sinusoidal PWM- Third Harmonic PWM- Space Vector Modulation-Comparison of PWM Techniques- Three phase current source inverters-Variable dc link inverter.

#### **UNIT IV**

### **Multilevel Inverters**

Introduction, Multilevel Concept, Types of Multilevel Inverters- Diode-Clamped Multilevel Inverter, Principle of Operation, Features of Diode-Clamped Inverter- Flying-Capacitors Multilevel Inverter-Principle of Operation, Features of Flying-Capacitors Inverter- Cascaded H-bridge Multilevel Inverter, Principle of Operation, Features of Cascaded H-bridge Inverter- Comparisons of Multilevel inverters.

**UNIT V** 

### **PWM Multilevel Inverters**

CHB Multilevel Inverter: SHE PWM- Phase shifted PWM-Level shifted PWM- Diode clamped Multilevel inverter: SHE PWM-Sinusoidal PWM- Space vector PWM-Capacitor voltage balancing **TEXT BOOKS:** 

#### IEAI DUUNS:

1. 1. Power Electronics: Converters, Applications, and Design- Ned Mohan, Tore M. Undeland, William P. Robbins, John Wiley& Sons, 2nd Edition, 2003.

2. Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First IndianReprint-2008.

3. HIGH-POWER CONVERTERS AND AC DRIVES – Bin Wu, Wiley-IEEE Press, 2006. **REFERENCE BOOKS:** 

1. Elements of Power Electronics – Philip T. Krein, Oxford University press, 2014.

- 2. Power Converter Circuits William Shepherd & Li Zhang-Yes Dee CRC Press, 2004.
- 3. Power Electronics Daniel W. Hart McGraw-Hill, 2011.

# **HVDC TRANSMISSION**

#### (Honors Engineering Course)

Lecture - '	Futoria	al:		3-1 Ho	urs		Int	erna	l Marl	ks:		30	
Credits:				3			Ext	terna	l Mar	ks:		70	
Course Ob	jective	es:											
<ul> <li>To a</li> <li>To b</li> <li>To b</li> <li>To b</li> <li>To b</li> <li>To b</li> <li>To b</li> </ul>	inalyse earn th earn ab inderst inique earn ab	the op e princ oout con and the in HVD oout M7	eration iples o nverter e requi Csyste TDC sys	f HVDC f HVDC rs fault remen m. stems a	DC conv System s and pr ts of rea	verters n contr rotecti active p circuit	ol. on sche oower o breake	emes contro ers.	of HVI ol and	DC syst filterir	tems. 1g		
<b>Course Outc</b>	omes		) -					-					
Upon suc	ccessful completion of the course, the student will be able to:												
C01	Learn	Learn the basic concepts of HVDC Transmission & their converters.											
CO2	Learn	Learn HVDC converters.											
CO3	Under	rstand	the HV	DC Sys	tem Coi	ntrol S	trategie	es wit	h resp	ect to	protect	tion.	
CO4	Under	rstand	the cor	ncepts	of HVD(	C syste	ms pro	tectio	n				
CO5	Under	rstand	the var	ious so	ources o	of reac	tive po	wer					
CO6	Under	rstand	the Mu	lti Teri	minal H	VDC Sy	ystems.						
Contribution	n of	Cour	se O	)utcome	es tov	wards	achie	veme	nt o	of Pi	rogram	Outcomes	
(1 – Low, 2-	Medium	1, 3 – Hig	sh)	DO	DO	DO	DO	DO	DO	DO	DO	DO	
	P0	PU 2	PU 3	P0 4	P0	6	P0 7	8	9 9	10	P0 11	P0 12	
C01													
CO2													
CO3													
CO4													
CO5													
CO6													

#### UNIT I

### **DC Power Transmission Technology**

Introduction - Historical Development - Comparison of AC and DC transmission - types of DC links -Existing HVDC Projects in INDIA. Modern Trends in HVDC Technology.

### **Analysis of HVDC Converters**

Three Phase 6-Pulse bridge converter - simplified analysis - waveform with and without overlap - Current and voltage relationship - Equivalent circuits of converters - Analysis of a 12 pulse converters.

### UNIT II

## **HVDC System Control**

Principles of DC link control - converter control characteristics - constant current and constant extinction angle control - constant ignition angle control - starting and stopping of HVDC link - powercontrol & power reversal in HVDC link.

### **UNIT III**

### **Converter Faults and Protection**

Over voltages in converter station - Surge arrestors - Protection against over voltages and over currents.Converter faults - Protection against faults in voltage source converter-Smoothing Reactor - Transient over voltages for DC line – Protection of DC lines.

### **UNIT IV**

### **Reactive Power Control**

Sources of reactive power - Static VAR system – SVC and STATCOM - Reactive power control duringtransients.

### Harmonics & Filters

Generation of harmonics – Types and design of various AC filters - DC filters – Active Filters.

### UNIT V

### Multi Terminal HVDC Systems & DC Circuit Breakers

Types of MTDC systems - Control and Protection of MTDC system – HVDC insulation – DC lineinsulators – DC breakers – Characteristics and types of DC breakers.

### **TEXT BOOKS:**

- 1. K. R. Padiyar "HVDC Power Transmission Systems Technology and System Interactions" -New Age International (p) Limited New Delhi 2003.
- 2. Edward Wilson Kimbark "Direct current Transmission" Wiley Interscience - Vol. I - NewYork - 1971.

### **REFERENCE BOOKS:**

- 1. Vijay K. Sood "HVDC and FACTS Controller: Application of Static Converters in power systems" IEEE Power Electronics and Power Systems series Kluwer Academic publishers Boston First edition January 2004.
- 2. C. Adamson and N.G. Hingorani "High voltage DC power Transmission" GarrawayLimited England 1960.
- 3. Mohan Undeland and Robbins "Power Electronics Converters Applications and Design JohnWiley & Son Inc. 2003.
- 4. J. Arrialga "HVDC Transmission" Peter Peregrinus Ltd. London 1983.

### EVOLUTIONARY ALGORITHMS (Minors Engineering Course)

Lecture	– Tutori	al:	3	3-1 Hou	rs		Int	erna	l Marl	KS:		30	
Credits:				3			Ext	terna	l Mar	ks:		70	
Course (	Objective	es:											
	To classical	lassify o rithms.	optimiz	zation p	roblen	ns and	learn tl	he fea	tures	of soft	compu	ting	
	≻ To l	earn th	ie step	s of GA	and I	PSO alg	gorithn	ns an	d the	ir app	lication	s to	
	solv	e Rose	nbrock	&Rasti	igin fu	inction	test p	roblei	ns.				
	> To le	earn HS	A and	ABC alg	orithn	ns & th	eir app	olicati	on to s	solve I	Rosenbi	rock &	
	Rast	rigin fu	nction	test pro	blems								
	> To il	lustrat	e the st	eps of S	FLA &	Bat op	otimiza	tion a	lgorit	hms &	their		
	appl	ication	to solv	restanda	ard sin	gle obj	ective	test p	robler	ns.	NCCAI	T	
	o learn th	ie basic	conce	pts of m	ulti-ob	jective	optim	izatio	n & st	eps of	NSGA-I	lalgorithm	
Course Ou	itcomes						<b>4b a a</b>			-111 1			
Upon s	Upon successful completion of the course, the student will be able to:												
01	state and formulate the optimization problem, without and with constraints, by using designvariables												
<u> </u>	using designvariables.												
CO2	Apply G	A and F	'SU algo	orithms	to sol	ve sing	le obje	ctive	optim	izatior	i proble	ems	
CO4	Apply H	SA algo	rithms	to solv	e singl	e objec	tive op		ation	proble	ems.		
	Apply A	BC algo	rithms	to solv	e singl	e objec	tive op	otimiz	ation	proble	em5.		
	Apply B	at and s	SFL alg	orithms	to sol	ve sing	le obje	ctive	optim		i proble	ems	
006	Formula	ate mul	ti-obje	ctive of	otimiza	ation p	roblem	i and	use N	SGA-L	l to sol	ve two	
Contribut	ion of	<u>eoptim</u>				wards	achio	vomo	nt o	f Di	rogram	Outcomes	
(1 – Low, 2	2- Medium	1, 3 – Hig	sc o gh)	utcomes	,	warus	actific	venie		1 11	ogram	outcomes	
	PO	PO	РО	PO	PO	PO	PO	PO	PO	PO	PO	РО	
<u> </u>	1	2	3	4	5	6	7	8	9	10	11	12	
CO2													
C02													
C04													
C05													
C06													

UNIT I

### **Fundamentals of Soft Computing Techniques**

Definition-Classification of optimization problems- Unconstrained and Constrained optimization Optimality conditions- Soft computing techniques- Conventional Computing versus Soft Computing - Classification of meta-heuristic techniques - Single solution based and population based algorithms – Exploitation and exploration in population based algorithms - Discrete and continuous optimization problems - Single objective and multi-objective problems.

### UNIT II

### Genetic Algorithm and Particle Swarm Optimization

Genetic algorithms- Genetic Algorithm versus Conventional Optimization Techniques -Genetic representations and selection mechanisms; Genetic operators- different types of crossover and mutation operators -Bird flocking and Fish Schooling – anatomy of a particle- equations based on velocity and positions -PSO topologies - control parameters – GA and PSO algorithms for solving standard Rosenbrock, Rastrigin function test problem

### UNIT III

### Harmony Search Optimization and Artificial Bee Colony Algorithms

Harmony Search algorithm – steps – Harmony memory initialization, New harmony improvisation, Harmony memory update – Improved Harmony search algorithm.

Task partitioning in honey bees - Balancing foragers and receivers - Artificial bee colony (ABC)algorithms-HSA and ABC algorithms to solve Rosenbrock & Rastrigin function test problems.

#### **UNIT IV**

### Shuffled Frog-Leaping Algorithm and Bat Optimization Algorithm

Bat Algorithm- Echolocation of bats- Behaviour of microbats- Acoustics of Echolocation- Movement of Virtual Bats- Loudness and Pulse Emission- Shuffled frog algorithm-virtual population of frogs- comparison of memes and genes -memeplex formation- memeplex updation- BA and SFLA algorithms to solve Rosenbrock & Rastrigin function test problems.

#### UNIT V

#### **Multi Objective Optimization**

Multi-Objective optimization Introduction- Concept of Pareto optimality - Nondominant sorting technique-Pareto fronts-best compromise solution-min-max method-NSGA-II algorithm and application to solve general two objective optimization problem.

#### **TEXT BOOKS:**

1. Xin-She Yang, "Recent Advances in Swarm Intelligence and Evolutionary Computation",

Springer International Publishing, Switzerland, 2015.

- Kalyanmoy Deb "Multi-Objective Optimization using Evolutionary Algorithms", John Wiley & Sons, 2001.
- 3. James Kennedy and Russel E Eberheart, "Swarm Intelligence", The Morgan Kaufmann Series in

Evolutionary Computation, 2001.

### **REFERENCE BOOKS:**

1. Eric Bonabeau, Marco Dorigo and Guy Theraulaz, "Swarm Intelligence-From natural to Artificial

Systems", Oxford university Press, 1999.

2. David Goldberg, "Genetic Algorithms in Search, Optimization and Machine

Learning", Pearson Education, 2007.

- 3. Konstantinos E. Parsopoulos and Michael N. Vrahatis, "Particle Swarm Optimization andIntelligence: Advances and Applications", Information science reference, IGI Global, , 2010.
- 4. N P Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2005.

### **REFERENCE PAPERS**

- 1. "Shuffled frog-leaping algorithm: a memetic meta-heuristic for discrete optimization" by Muzaffar eusuff, Kevin lansey and Fayzul pasha, Engineering Optimization, Taylor & Francis, Vol. 38, No. pp.129–154, March 2006.
- 2. "A New Metaheuristic Bat-Inspired Algorithm" by Xin-She Yang, Nature Inspired Cooperative Strategies for Optimization (NISCO 2010) (Eds. J. R. Gonzalez et al.), Studies in Computational Intelligence, Springer Berlin, 284, Springer, 65-74 (2010).
- 3. K. Nekooei, M. M. Farsangi, H. Nezamabadi-Pour and K. Y. Lee, "An Improved Multi-Objective Harmony Search for Optimal Placement of DGs in Distribution Systems," in IEEE Transactions on Smart Grid, vol. 4, no. 1, pp. 557-567, March 2013, doi: 10.1109/TSG.2012.2237420.

### **FUNDAMENTALS OF POWER ELECTRONICS**

### (Minors Engineering Course)

Lecture	– Tutoria	al:		3-1 Hou	ırs		Int	terna	l Mar	ks:		30		
Credits:				3			Ext	terna	l Mar	ks:		70		
Course (	Objective	es:												
	<ul> <li>To kno</li> </ul>	w the o	charact	eristics	of var	ious po	wer se	mico	nducto	or devi	ces.			
	To lea	rn the	operat	tion of s	single	phase	full-wa	ave c	onver	ters ar	nd perfo	orm		
	harmo	nic ana	alysis o	ofinput	curren	it.								
×	• To lear	n the c	peratio	on of th	ree ph	ase full	-wave	conv	erters	and A	C/AC co	nverters.		
	• To lear	n the c	operatio	on of di	terent	types o	of DC-L	C cor	iverte	rs.				
	• To lear	n the o	peratio	on of PV	VM inv	verters	tor vol	tage c	ontro	l and h	armoni	С		
	mitigat	tion.												
Cource Or	teomoc													
Ilnon s	nccessf	iul con	nnlot	ion of	the c	niirco	the	stud	ont w	vill he	ahlet	יסי		
CO1	Illustrat	a tha s	tatic an	nd dyna	mic ch	aracter	istice S			r MOSI	FT and	Power		
001	ICRT	e the s	tatic all	iu uyna		aracter	131103 0		TOWE	1 10001		10000		
CO2	Analyse the operation of phase controlled rectifiers.													
CO3	Analyse the operation of Three-phase full–wave converters													
<b>CO4</b>	Analyse the operation of Three-phase full–wave converters Analyse the operation of AC Voltage Controllers and Cyclo-converters													
CO5	Examin	e the or	peratio	n and d	esign (	of differ	ent tvi	bes of	DC-D	C conv	erters.			
CO6	Analyse	the op	eratior	n of PWI	M inve	rters fo	r volta	ge co	ntrol a	and har	monic	mitigation		
Contribut	ion of	Cou	rse (	Dutcome	s to	wards	achie	veme	nt o	of Pr	ogram	Outcomes		
(1 - Low, 2	2- Medium	n, 3 – Hig	gh)					1 -			_			
	PO 1	PO 2	PO 2	PO	PO F	PO	P0	PO	PO	PO	PO 11	PO		
C01	1	<u> </u>	3	4	5	0	1	0	9	10	11	12		
C02														
CO3														
C04														
C05														
C06														
						UNIT I								
<b>Power</b> Silic	Semi-Co	ondu olled re	<b>ctor D</b> ectifier	<b>evices</b> (SCR) -	<b>5</b> - Two t	ransist	or anal	ogy -	Static	and D	ynamic			

Static and Dynamic Characteristics of Power MOSFET and Power IGBT– Gate Driver Circuits forPower MOSFET and IGBT - Numerical problems.

UNIT II

### Single-phase AC-DC Converters

Single-phase half wave controlled rectifiers - R load and RL load with and without freewheeling diode - Single-phase fully controlled bridge converter with R load - RL load and RLE load - Continuous and Discontinuous conduction - Expression for output voltages – Single-phase Semi-Converter with R load - RL load and RLE load – Continuous and Discontinuous conduction - Harmonic Analysis - Numerical Problems.

### UNIT III

### Three-phase AC-DC Converters & AC – AC Converters

Three-phase fully controlled rectifier with R and RL load - Three-phase semi converter with R and RLload - Expression for Output Voltage - Harmonic Analysis - Numerical Problems.

AC-AC power control by phase control with R and RL loads - Expression for rms output voltage-Numerical problems.

### **UNIT IV**

### **DC-DC Converters**

Analysis of Buck - Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) - Output voltage equations using volt-sec balance in CCM & DCM – Expressions for output voltage ripple and inductor current ripple- Numerical Problems.

### UNIT V

### **DC-AC Converters**

Introduction - Single-phase half bridge and full bridge inverters with R and RL loads – Three-phase square wave inverters - 120^o conduction and 180^o conduction modes of operation - PWM inverters - Sinusoidal Pulse Width Modulation - Numerical Problems.

### **TEXT BOOKS:**

- 1. Power Electronics: Converters Applications and Design by Ned Mohan Tore M Undeland -William P Robbins John Wiley & Sons.
- 2. Power Electronics: Circuits Devices and Applications by M. H. Rashid Prentice Hall of India
  - 2nd edition 1998
- 3. Power Electronics: Essentials & Applications by L. Umanand Wiley Pvt. Limited India 2009.

#### **REFERENCE BOOKS:**

- 1. Elements of Power Electronics-Philip T.Krein. Oxford University Press; Second edition
- 2. Power Electronics by P.S.Bhimbra Khanna Publishers.
- 3. Power Electronics: by Daniel W.Hart Mc Graw Hill.

### RENEWABLE AND DISTRIBUTED ENERGY TECHNOLOGIES (PROFESSIONAL ELECTIVE-III)

Lectu	re – Tı	itoria	1:	3	-1 Hou	ırs		Int	ernal	Marks	:	30	
Credit	ts:			3				Ext	ernal	Marks	:	70	
Cours	e Obje	ctives	5:										
$\succ$	To un	lerstar	nd the	basio	c conc	epts of	n win	d ener	gy sys	stems	with cor	ncept on	
	aerody	namics	s, horiz	ontal a	and ve	rtical a	xis wi	nd turb	ines.				
$\succ$	To und	erstan	d the	various	s relati	ions bet	tween	speed,	power	and en	nergy in	the wind	
	system	s.											
$\succ$	It pro	vides	the kr	nowled	ge in	fundar	nenta	ls of s	olar e	nergy	systems,	various	
	compo	nents d	of solar	thern	al sys	tems, a	pplica	tions i	n the r	elevant	fields an	d design	
	of PV s	vstems	8.		5	,						U	
$\triangleright$	To und	erstan	d the F	Ivdel s	vstem	compo	nents	and th	eir des	ign cor	ncepts.		
$\triangleright$	To get	an ide	ea on	differ	ent of	her sou	irces	like tid	al. geo	otherma	al and g	as based	
	units.							010	, 500				
$\succ$	To und	erstan	d the u	use of v	various	s renew	able s	ources	as dis	tribute	d generat	ors	
Course	Outcor	nes											
Upon	SUCC	essfu	il cor	nplet	tion	of the	cou	rse. t	he st	uden	t will ł	oe able	
to:				<b>F</b>				,					
CO1	Illustr	ate ha	sic con	cents	of rene	wable	and di	istribut	ed sou	rces			
	I Illustrate basic concepts of renewable and distributed sources												
CO2	Demo	nstrate	e the co	ompon	ents o	f wind e	energy	v conve	rsion s	ystems	•		
CO3	Mode	PV sy	stems	and ar	nalyse	МРРТ Т	èchni	ques					
C04	Illust	ote the	- conce	ent of I	Therm	Produc	ntion f	rom Hy	dro - 1	Tidal ar	nd Geothe	ermal	
	musti	ate th	conce	prori	Jiicigy	IIOuut		10111 115	uio i	indar ar		, man.	
CO5	Distin	guish	betwee	n star	dalone	e and g	rid coi	nnected	l DG sy	ystems			
C06	Desig	n hybr	<u>id rene</u>	wable	energy	y systen	ns.						
Contril (1 - Lo	oution w 2.M	01 C edium	ourse	Outc wh)	omes	toward	is ac	chieven	ient	of Pro	ogram C	Jutcomes	
(1 20	PO	PO	PO	<u>PO</u>	PO	PO	PO	PO	PO	PO	PO	РО	
	1	2	3	4	5	6	7	8	9	10	11	12	
CO1	3	2									1		
CO2	3	3									1		
CO3	3 3 3 1												
C04													
C05	3	2											
C06	3	2											
L	1	I	I			I I		1	I		<u> </u>		
						TINT	тт						
Brief	den or	rance	wahla	h han	intrih			a tha	ir 1100	fulmoor	and ad	vontogoo	
	uca UI		wable		.19(110)		· 1	s - me	n usel		s anu au	ivaniages	

Wind Energy Systems: Estimates of wind energy potential - wind maps - Instrumentation for wind velocity measurements - Aerodynamic and mechanical

aspects of wind machine design - Conversion to electrical energy - Aspects of location of wind farms.

### UNIT II

Wind speed and energy - Speed and power relations - Power extraction from wind - Tip speed ratio (TSR) - Functional structure of wind energy conversion systems - Pitch and speed control - Power- speed-TSR characteristics - Fixed speed and variable speed wind turbine control - Power optimization - Electrical generators - Self-Excited and Doubly-Fed Induction Generators operation and control.

#### UNIT III

Solar PV Systems: Present and new technological developments in photovoltaic - estimation of solar irradiance - components of solar energy systems - solar-thermal system applications to power generation - heating - Types of PV systems - Modelling of PV cell current-voltage and power-voltage characteristics - Effects of temperature - Solar array simulator - Sun tracking - Peak power operations - PV system - MPPT techniques - Effects of partial shading on the characteristic curves and associated MPPT techniques - Solar park design outline.

### UNIT IV

Hydel Power: Water power estimates - use of hydrographs - hydraulic turbine - characteristics and part load performance - design of wheels - draft tubes and penstocks - plant layouts; Brief idea of other sources viz. - tidal - geothermal - gas-based - etc.

### UNIT V

Requirements of hybrid/combined use of different renewable and distributed sources -Need of energy storage; Control of frequency and voltage of distributed generation in Standalone and Grid-connected mode - use of energy storage and power electronics interfaces for the connection to grid and loads - Design and optimization of size of renewable sources and storages.

### **TEXT BOOKS:**

1. Math J. Bollen - Fainan Hassan Integration of Distributed Generation in the Power System' - IEEE Press - 2011.

2. Loi Lei Lai and Tze Fun Chan 'Distributed Generation: Induction and Permanent Magnet Generators' - Wiley-IEEE Press - 2007.

3. Studies' Craig Anderson and Rudolf I. Howard 'Wind and Hydropower Integration: Concepts - Considerations and Case - Nova Publisher - 2012.

4. Amanda E. Niemi and Cory M. Fincher 'Hydropower from Small and Low-Head Hydro Technologies' - Nova Publisher - 2011.

6. D. Yogi Goswami - Frank Kreith and Jan F. Kreider 'Principles of Solar Engineering' - Taylor & Francis 2000.

7. G. N. Tiwari 'Solar Energy Technology' - Nova Science Publishers - 2005.

### **REFERENCE BOOKS:**

1. Math J. Bollen - Fainan Hassan Integration of Distributed Generation in the Power System' - IEEE Press - 2011.

2. S. Heier and R. Waddington 'Grid Intergration of Wind Energy Conversion Systems' – Wiley - 2006.

### HIGH VOLTAGE ENGINEERING (PROFESSIONAL ELECTIVE – IV)

Lecture -	- Tuto	rial:	3	3-1 Hc	ours		Inte	erna	l Mar	ks:		30		
Credits:				3			Ext	erna	1 Mar	ks:		70		
Course C	)bjecti	ves:												
> To	unders	tand H	V brea	kdowr	n pheno	omena	in gas	es.						
> To	unders	stand t	he bre	akdow	n phen	omeno	on of li	quids	and a	solid d	lielectri	ics.		
> To	acqua	int wit	h the	genera	ting p	rincipl	e of op	oerati	on an	d des	sign of	HVDC, AC		
volt	tages.													
> To	unders	stand t	he gen	erating	g princ	iples o	f Impu	lse vo	oltage	s & cu	irrents.			
> To	unders	stand v	various	s techn	iques f	for AC	, DC a	nd In	npulse	meas	sureme	nts of high		
volt	tages a	nd cur	rents.											
Course Ou	tcomes	5												
Upon sı	icces	ccessful completion of the course, the student will be able												
to:														
CO1	Recognise the dielectric properties of gaseous materials used in HV equipment													
CO2	Differ	Differentiate the break down phenomenon in liquid and solid dielectric												
	mater	materials												
CO3	Acqu	aint wi	th the	techni	ques of	f gener	ration o	of hig	h AC a	and D	C volta	ges		
CO4	Acqua	aint w	ith th	e tech	niques	of ge	neratio	on of	` high	Impu	alse vo	ltages and		
	curre	nts												
CO5	Getti	ng the	knowle	edge of	measu	iremer	nt of hi	gh A0	C - DC	C - Imj	pulse v	oltages		
CO6	Getti	ng the	knowle	edge of	measu	iremer	nt of hi	gh A0	C - DC	C - Imj	pulse c	urrents		
Contributi	on of	Cou	rse O	utcom	es tov	wards	achie	veme	nt o	f Pr	ogram	Outcomes		
(1 - Low, 2)	2- Mediu	um, 3 -	High)	PO	PO	PO	PO	PO	PO	PO	PO	PO		
	1	2	3	4	F0 5	F0 6	F0 7	8	РО 9	10	11	12		
CO1	3		-		-	-	-	-	-					
CO2	3													
CO3	3	2												
C04	3	2												
CO5	3													
C06	3	2												

### UNIT I

### Break down phenomenon in Gaseous:

Insulating Materials: Types - applications and properties. Gases as insulating media – Collision process – Ionization process – Townsend's criteria of breakdown in gases and its limitations – Streamers Theory of break down – Paschen's law- Paschens curve.

### UNIT II

**Break down phenomenon in Liquids:** Liquid as Insulator – Pure and commercial liquids – Breakdown in pure and commercial liquids.

Break down phenomenon in Solids: Intrinsic breakdown – Electromechanical breakdown

- Thermal breakdown -Breakdown of composite solid dielectrics

### UNIT III

**Generation of High DC voltages**: Voltage Doubler Circuit - Voltage Multiplier Circuit - Vande- Graaff Generator. **Generation of High AC voltages**: Cascaded Transformers - Resonant Transformers – Tesla Coil

#### UNIT IV

**Generation of Impulse voltages:** Specifications of impulse wave – Analysis of RLC circuit only- Marx Circuit. **Generation of Impulse currents:** Definitions – Circuits for producing Impulse current waves – Wave shape control - Tripping and control of impulse generators.

#### UNIT V

**Measurement of High DC & AC Voltages**: Resistance potential divider - Generating Voltmeter - Capacitor Voltage Transformer (CVT) - Electrostatic Voltmeters – Sphere Gaps.

### **TEXT BOOKS:**

1. High Voltage Engineering: Fundamentals by E.Kuffel - W.S.Zaengl - J.Kuffel by Elsevier - 2 nd Edition.

2. High Voltage Engineering and Technology by Ryan - IET Publishers - 2 nd edition.

### **REFERENCE BOOKS:**

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications - 3 rd Edition.

2. High Voltage Engineering by C.L.Wadhwa - New Age Internationals (P) Limited – 1997.

3. High Voltage Insulation Engineering by RavindraArora - Wolfgang Mosch - New Age International (P) Limited - 1995.

### POWER SYSTEM OPERATION AND CONTROL (PROFESSIONAL ELECTIVE -V)

Lectu	ire – Tu	orial:	(	3-1 Ho	ours		Int	erna	1 Mar	ks:		30	
Credi	ts:			3			Ext	erna	1 Mai	rks:		70	
Cours	se Objec	tives:											
$\mathbf{A}$	To unde	rstand o	ptimal	dispat	ch of g	genera	tion wi	th an	d witł	nout lo	osses.		
$\succ$	To unde	rstand t	he opti	mal sc	heduli	ng of ł	nydro ti	herm	al sys	tems.			
$\succ$	To unde	erstand	the opt	imal u	nit cor	nmitm	ent pro	blem	l <b>.</b>				
$\succ$	To und	erstand	the loa	d frequ	Jency (	contro	l for sin	ngle a	area s	ystem	with a	nd with	out
	controlle	ers		-	-			-					
$\triangleright$	To und	erstand	the loa	ad freq	uency	contro	ol for t	wo a	rea sy	vstem	with a	nd with	out
	controlle	ers		-					-				
$\triangleright$	To unde	erstand	the rea	ctive p	ower c	ontrol	and co	mper	nsatio	n of tr	ransmis	sion line	es.
Course	e Outcom	es											
Upon	1 succe	ssful (	comp	letio	n of	the c	ourse	e, tł	ie st	uder	nt will	l be ab	le
to:			-										
CO1	Compu	te optim	al load	sched	uling c	of Gene	erators	•					
CO2	Formul	ate hydr	otherm	al sch	edulin	g and	unit co	mmi	tment	probl	em		
CO3	Analyse	effect o	f Load	Freque	ency C	ontrol	for sing	gle ar	ea sys	stems			
CO4	Analyse	effect o	f Load	Freque	ency C	ontrol	for two	area	syste	ems			
CO5	Describ	e the eff	ect of r	eactive	e powe	r conti	col for t	rans	missio	on line	es.		
CO6	Describ	e unde	erstand	l the	reac	tive p	ower	cont	rol a	and	comper	nsation	of
	transm	ssion lin	nes.										
Contri	bution	of Cou	rse O	utcom	es to	wards	achie	veme	ent c	of Pr	ogram	Outcon	nes
(1 – Lo	w, 2- Me	<u>lium, 3 -</u>	- High)	DO	DO		DO		DO	DO		DO	
	PO 1	2	PO 3	PO 4	PO 5	P0 6	PO 7	8	9	10	11	PO 12	
CO	1 3	2	2	•		Ū	-	3	2	10		14	
CO2	2 3	3	3					2	2				
COS	3 3	3	2					2	2				
CO4	4 3	3	2					3	2				
COS	53	3	3										
COe	5 3	3	2										
					1	UNIT	I						
Econo	omic O	peratio	n of	Powe	r Sys	tems	Optin	mal	opera	tion	of Ge	nerator	s in
Therm	nal powe	er statio	ons - ·	– Hea	t rate	curve	e – Co	st C	urve	– Inc	remen	tal fuel	and
Produ	iction co	osts – I	nput-o	output	t char	acteri	stics -	- Op	timur	n ger	neratio	n alloca	tior

with line losses neglected – Optimum generation allocation including the effect of transmission line losses – Loss Coefficients – General transmission line loss formula.

### UNIT II

**Hydrothermal Scheduling** Mathematical Formulation – Solution Technique.

**Unit Commitment** Need for unit commitment – Constraints in unit commitment – Cost function formulation – Solution methods – Priority ordering – Dynamic programming.

### UNIT III

**Load Frequency Control-I** Modelling of steam turbine – Generator – Mathematical modelling of speed governing system – Transfer function – Necessity of keeping frequency constant. Definitions of Control area – Single area control system – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case. Proportional plus Integral control of single area and its block diagram representation – Steady state response.

### UNIT IV

**Load Frequency Control-II** Block diagram development of Load Frequency Control of two area system uncontrolled case and controlled case – Tie-line bias control – Load Frequency Control and Economic dispatch control.

### UNIT V

**Compensation in Power Systems** Overview of Reactive Power control – Reactive Power compensation in transmission systems – Advantages and disadvantages of different types of compensating equipment for transmission systems – Load compensation – Specifications of load compensator – compensated transmission lines. Introduction of FACTS devices – Need of FACTS controllers – Types of FACTS devices.

### TEXT BOOKS:

1. Power Generation - Operation and Control by Allen J Wood - Bruce F WollenBerg 3rd Edition - Wiley Publication 2014.

2. Electric Energy systems Theory – by O.I.Elgerd - Tata McGraw–hill Publishing Company Ltd. - Second edition. 3. Modern Power System Analysis – by I.J.Nagrath&D.P.Kothari Tata McGraw Hill Publishing Company Ltd - 2nd edition.

### **REFERENCE BOOKS:**

1. Power System Analysis and Stability by S.S.Vadhera - Khanna Publications - 4 th edition - 2005.

2. Power System Analysis by Grainger and Stevenson - Tata McGraw Hill.

3. Power System Analysis by HadiSaadat – – Tata McGraw–Hill 3rd edition - 2010.

4. Power System stability & control - Prabha Kundur - TMH - 1994.

### HIGHWAY ENGINEERING (OPEN ELECTIVE -III)

	re – Tuto	rial:		3-1 Ho	ours		Int	erna	l Mar	ks:		30		
Credit	:s:		3	3			Ext	erna	1 Maı	:ks:		70		
Cours	e Object	ives:												
1. To in	npart kno	wledge	on hig	ghway	develop	oment	and m	ateria	als.					
2. To te	each conc	epts of	Geome	etric de	esign a	nd alig	gnment	t.						
3. To tl	nrow light	on tra	ffic vol	ume st	tudies a	and re	gulatio	n.						
4. To te	each desig	gn of hi	ghway	inters	ections									
5. To ii	npart kno	wledge	on de	sign of	pavem	ients.								
Course	Outcomes	5												
Upon	succes	sful o	comp	letio	n of t	the c	ourse	e, th	ie st	uder	it wil	l be able		
to:														
CO1	Carry out highway surveying and planning.													
CO2	Understand characteristics of highway materials.													
CO3	Geometric design and alignment													
CO4	Design co	ompone	ents of	highw	ay									
CO5	Design h	ighway	inters	ections	3.									
CO6	Design h	ighway	paven	ients.										
Contrib	oution of	Cou	rse O	utcom	es to	wards	achie	veme	ent c	of Pro	ogram	Outcomes		
(1 – Lov	v, 2- Medi	um, 3 –	· High)								0			
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO		
	1	2	3	4	5	6	7	8	9	10	11	12		
C01	2													
CO2	2													
CO3	2	3	3			2		1						
C04	2	3	3			2		1						
C05	2	3	3			2		1						
C06	2	3	3			2		1						

### UNIT I

**HIGHWAY DEVELOPMENT AND PLANNING:** Highway development in India – Necessity for Highway Planning- Road Development Plans- Classification of RoadsRoad Network Patterns – Highway Alignment and influencing Factors – Engineering Surveys

### UNIT II

**HIGHWAY GEOMETRIC DESIGN**: Importance of Geometric Design- Design controls and Criteria-Highway Cross Section Elements-Sight Distance Elements-Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance.

### UNIT III

**TRAFFIC ENGINEERING:** Basic Parameters of Traffic-Volume, Speed and DensityTraffic Volume Studies; Speed studies–spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures-,

Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Traffic Signals–Webster Method–IRC Method.

### UNIT IV

**HIGHWAY MATERIALS**: Sub grade soil: classification–Group Index–Subgrade soil Strength-California Bearing Ratio– Modulus of Subgrade Reaction. Stone aggregates: Desirable properties–Tests for Road Aggregates–Bituminous Materials: Types–Desirable properties–Tests on Bitumen

### UNIT V

**PAVEMENT DESIGN:** Flexible and rigid pavements – Components and Functions – design of Flexible pavement (G.I method and CBR Method as per IRC 37-2018 – Design of Rigid pavements – Westergaard's stress equations – CC pavements - Design of Expansion and contraction joints.

### **TEXT BOOKS:**

- 1) S. K. Khanna and C. E. G. Justo, Highway Engineering, Nemchand & Bros., 7th edition (2000).
- 2) R. Srinivasa Kumar, Text Book of Highway Engineering, Universities Press Pvt Ltd, Hyderabad. 2011.

### **REFERENCE BOOKS:**

- 1) S K Sharma, A Textbook Of Highway Engineering, S. Chand and Company Limited, New Delhi
- 2) L. R. Kadiyali and Lal, Principles and Practice of Highway Engineering Design, Khanna Publications.

### SAFETY ENGINEERING (OPEN ELECTIVE -IV)

Lectu	re – '	Tuto	rial:		3-1 Ho	ours		Inte	erna	1 Mar	ks:		30
Credi	ts:			3	3			Ext	erna	1 Mar	ks:		70
Cours	e Ob	ojecti	ves:										
1)	To u	nders	stand	the co	ncept	s of ind	dustri	al safe	ety a:	nd ma	anage	ment.	
2)	To de	emon	strate	the a	ccider	nt prev	entior	ns and	l pro	tectiv	e equ	ipmen	t.
3)	To u	nders	stand	and a	pply tl	ne kno	wledg	ge of sa	afety	acts			
4)	To h	ave tl	he kno	owledg	ge abo	ut fire	preve	ntion	and	prote	ction	systen	18
5)	To u	nders	stand	and a	pply fi	re safe	ety pri	nciple	s in	build	ings		
Course	Outo	comes	<b>C</b> 1		1	<b>C</b> 4	1				-		
Upon	l suc	cces	stul o	comp	letio	n of t	he c	ourse	e, th	ie st	uden	it wil	l be able
to:	1												
CO1	Students learn the concepts of industrial safety and management												
CO2	Learn about the smart machines and smart sensors												
CO3	Apply IoT to Industry 4.0 and they are able to make a system tailor-made as per												
	requ	ireme	ent of t	the ind	ustry								
CO4	Stuc	dents	learn a	about f	ire pre	ventior	n and j	protect	tion s	ystem	.S		
CO5	Stuc	dents	learn 1	the fire	safety	r princi	ples ir	ı buildi	ings				
CO6	Stuc	dents	should	1 apply	the fir	re safet	y prin	ciples	in bu	ilding	s		
Contri	butio	n of	Cou	rse O	utcom	es tov	wards	achie	veme	ent o	f Pro	ogram	Outcomes
(1 – Lo	w, 2-	Mediu	<u>111, 3 -</u>	High)									
		РО 1	PO 2	PO 3	РО 4	РО 5	PO 6	PO 7	PO 8	90 9	PO 10	PO 11	PO 12
CO1	L	3	2	2		•	Ŭ		3	2	10		
CO2	2	3	3	3					2	2			
CO3	3	3	3	2					2	2			
CO4	F T	3	3	2					3	2			
CO5	5	3	3	3									
COG	5	3	3	2									

#### UNIT I

INTRODUCTION TO THE DEVELOPMENT OF INDUSTRIAL SAFETY AND

**MANAGEMENT**: History and development of Industrial safety: Implementation of factories act, Safety and productivity, Safety organizations. Safety committees and structure, Role of management and role of Govt. in industrial safety.

#### UNIT II

**ACCIDENTPREVENTIONS AND PROTECTIVE EQUIPMENT**: Personal protective

equipment, Survey the plant for locations, Part of body to be protected, Education and training insafety,Preventioncausesandcostofaccident,Housekeeping,Firstaid,Accidentre porting, Investigations. Industrial psychology in accident prevention, Safety trials, Safety related to operations.

### UNIT III

**SAFETY ACTS**: Features of Factory Act, Introduction of Explosive Act, Boiler Act, ESI Act, Workman's compensation Act, Industrial hygiene, Occupational safety, Diseases preventio n, Ergonomics, Occupational diseases, stress, fatigue, health, safety and the physical environment, Engineering methods of controlling chemical hazards, safety and the physical environment, Control of industrial noise and protection against it

### UNIT IV

**FIRE PREVENTION AND PROTECTION**: Sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E-fire extinguishing agents– types of fire extinguishers – fire stoppers –hydrant pipes – hoses – monitors – fire watchers– fire station-fire alarmsand sirens – escape from fire rescue operations – fire drills –first aid for burns.

### UNIT V

**BUILDINGFIRESAFETY**: Objectives of fire safe building design, fire load, fire resistant material and fire testing – structural fire protection – structural integrity – concept of egress design -A case Study on Construction Safety - Contractual Provision on Construction Zone Safety

**ELECTRICAL SAFETY**- Electrical shock, electrical hazards and preventions, Nature of electrical accidents, National electrical standards

### TEXT BOOKS:

1) Industrial Maintenance Management Srivastava, S.K.-S. Chand and Co.

2) OccupationalSafetyManagementandEngineeringWillieHammer–PrenticeHall **REFERENCE BOOKS:** 

- 1) Installation, Servicing and Maintenance Bhattacharya, S.N.-S. Chand and Co.
- 2) OccupationalSafetyManagementandEngineeringWillieHammer-PrenticeHall

3) Reliability, Maintenance and Safety Engineering by Dr.A. K.Guptha

4) Atext bookof Reliability and Maintenance Engineering byAlakeshManna

### **GREEN ENERGY**

### (OPEN ELECTIVE)

Lectu	ıre – '	Tuto	rial:		3-1 Ho	ours		Inte	erna	l Mar	ks:		30	
Credi	ts:				3			Ext	erna	1 Maı	ks:		70	
Cours	se Ob	jecti	ves:											
$\triangleright$	To st	udy tl	he sola	ır radia	ation d	ata, eq	uivale	nt circi	uit of	PV ce	ell and	l its I-V	/ & P-V	
	chara	acteria	stics.											
	To ur	nderst	tand th	ne cono	cept of	Wind I	Energy	v Conve	ersior	1 & its	appli	ications	s.	
4	To st	udy tl	he prir	nciples	of bio	mass a	nd geo	otherma	al ene	ergy.				
$\succ$	To ur	ndersi	tand th	ne prin	ciples	of Ocea	an The	ermal E	nerg	y Con	versio	n (OTE	C), motion	
~	of wa	ves a	nd pov	ver ass	sociate	d with i	1t.		-1	£11	11	1 1		
×	10 St		ne vari	ous cr	iemica	l energ	y sour	ces suc	ch as		cen ar	na nyai	rogen	
Course		29 alo.	iig witi	i then	opera	uon and	a equi	valent	circu	.11.				
IInor			eful d	omn	latia	n of t	he c	011#64	<u>+</u>	o et	ndor	1	l he shle	
opor	I Suc		siui (	omp	letio	11 01 (		ouise	, U	IC 31	uuei		i be able	
το:	Analyze solar radiation data, extra-terrestrial radiation; radiation on earth's													
C01	Analyze solar radiation data, extra-terrestrial radiation; radiation on earth's surface and solar													
	surface and solar Energy Storage.													
<u> </u>	Ener	rgy St	orage.		unta of				~					
CO2	Illus	trate	the co	mpone	of biom		icontor	system	S.		m10m	ta		
CO4	Dom	anale	the wo	n kilig	$\frac{01}{10}$	Tass, u	igestei	sanu	from		i pian	$\frac{18}{1000}$	Vouos	
C05	Evol		the cor	e princ	f Fuel		ица и	nower	gene	rotion	, 11uè	a anu	waves.	
C06	Eval	uaic 119te -	the wo	rking (	of Fuel	cells &	MHD	power	gene	ration	1. 1			
Contri	bution	n of		rse 0		es to	vards	achie	veme	ent o	f Pro	ogram	Outcomes	
(1 – Lo	w, 2-	Mediu	ım, 3 –	High)								- 8		
		PO	PO	PO	PO	PO	PO	РО	PO	PO	PO	PO	PO	
		1	2	3	4	5	6	7	8	9	10	11	12	
CO	1	3	2						2			1		
CO2	2	3	3											
CO	3	3	3						2					
CO4	4	3	3											
COS	5	3	3						2					
COe	6	3	3						2					

#### UNIT I

**Solar Energy**: Introduction - Renewable Sources - prospects, Solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.

### UNIT II

**Wind Energy**: Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.

				UNIT III							
Biomass	and	Geothermal	Energy:	Biomass:	Introduction	-	Biomass	conversion			
technologies - Photosynthesis, factors affecting Bio digestion - classification of biogas plants											
- Types of	biogas	s plants - selec	tion of site	e for a bioga	s plant						

**Geothermal Energy**: Introduction, Geothermal Sources – Applications - operational and Environmental problems.

#### UNIT IV

**Energy From oceans, Waves & Tides:** Oceans: Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India.

**Waves**: Introduction - Energy and Power from the waves - Wave Energy conversion devices. **Tides:** Basic principle of Tide Energy -Components of Tidal Energy.

#### UNIT V

**Chemical Energy Sources**: Fuel Cells: Introduction - Fuel Cell Equivalent Circuit – **Hydrogen Energy**: Introduction - Methods of Hydrogen production - Storage and Applications

Magneto Hydro Dynamic (MHD) Power generation: Principle of Operation - Types. TEXT BOOKS:

G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011.
 John Twidell & Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.

### **REFERENCE BOOKS:**

1. S.P.Sukhatme & J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011.

2. John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd Edition, 2013.

3. Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015.

### **UNIVERSAL HUMAN VALUES-2: UNDERSTANDING HARMONY**

Lectu	re – Tu	torial:		3-1 Ho	ours		Int	erna	1 Mar	ks:		30
Credits:				3			Ext	erna	1 Mar	ks:		70
Cours	e Obje	ctives:										
$\succ$	> To develop a holistic perspective based on self-exploration about themselves											
	(human being), family, society and nature/existence to understand (or developing											
clarity) of the harmony in the human being, family, society and nature/existence,												
to strengthen self-reflection and to develop the commitment and courage to act.												
Course	Outcor	nes										
Upon	l succ	essful	comp	letio	n of	the c	ours	e, tł	ie st	uden	it wil	l be able
to:												
CO1	Discuss a holistic perspective based on self-exploration about themselves											
CO2	Discuss a holistic perspective based on self-exploration about family,											
CO3	Discuss a holistic perspective based on self-exploration about society and											
	nature/existence											
CO4	To explain (or developing clarity) of the harmony in the human being, family											
CO5	To explain society and nature/existence, to strengthen self-reflection											
CO6	To judge the commitment and courage to act.											
Contribution of Course Outcomes towards achievement of Program Outcomes												
(1 – Lo	w, 2- Me	edium, 3	- High)									
		O PO	PO	PO 4	PO 5	PO 6	PO 7	PO	PO	PO 10	PO 11	PO 12
COI		2	1	1	0	<b>U</b>	-	2		10	1	12
CO2	2 3	3	1	1				2			1	
COS	3 3	3	1	1		2		2		2	1	
CO4	<del>ا</del> ا	3	1	1				2			1	
COS	5 3	3	1								1	
COG	5 3	3	1	1				3			1	

### UNIT I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1) Purpose and motivation for the course, recapitulation from Universal Human Values-I

2) Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration

3) Continuous Happiness and Prosperity- A look at basic Human Aspirations

4) Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority

5) Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

6) Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance

in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

#### UNIT II

Understanding Harmony in the Human Being - Harmony in Myself!

1) Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

2) Understanding the needs of Self (T) and 'Body' - happiness and physical facility

3) Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

4) Understanding the characteristics and activities of 'I' and harmony in 'I'

5) Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail 6) Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

### UNIT III

Understanding Harmony in the Family and Society- Harmony in Human Relationship

1) Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

2) Understanding the meaning of Trust; Difference between intention and competence

3) Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

4) Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

5) Visualizing a universal harmonious order in society- Undivided Society, Universal Orderfrom family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

### UNIT IV

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1) Understanding the harmony in the Nature

2) Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self regulation in nature

3) Understanding Existence as Co-existence of mutually interacting units in allpervasive space

4) Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

1) Natural acceptance of human values 2) Definitiveness of Ethical Human Conduct

3) Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

4) Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

5) Case studies of typical holistic technologies, management models and production systems

6) Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

7) Include practice: Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

### TEXT BOOKS:

1) Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

### **REFERENCE BOOKS:**

1) Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

2) Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3) The Story of Stuff (Book).

4) The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5) Small is Beautiful - E. F Schumacher. 6) Slow is Beautiful - Cecile Andrews.

7) Economy of Permanence - J C Kumarappa .

8) Bharat Mein Angreji Raj - PanditSunderlal .

9) Rediscovering India - by Dharampal.

10) Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.

11) India Wins Freedom - Maulana Abdul Kalam Azad.

12) Vivekananda - Romain Rolland (English).

13) Gandhi - Romain Rolland (English).

Credits: 3 INDUSTRIAL / RESEARCH INTERNSH YEAR (TO BE EVALUATED DURING VI	External Marks: IP 2 MONTHS (MANDATORY) I SEMESTER)	70 AFTER THIRE
INDUSTRIAL / RESEARCH INTERNSH YEAR (TO BE EVALUATED DURING VI	IP 2 MONTHS (MANDATORY) I SEMESTER)	AFTER THIRD
YEAR (TO BE EVALUATED DURING VI	I SEMESTER)	

	PROJECT					
Lecture – Tutorial:	-	Internal Marks:	3			
Credits:	12	External Marks:	7			
PROJECT WORK,	SEMINAR AND I	NTERNSHIP IN INDUSTRY (6 MON	ITHS)			