

PROGRAMME: B.E.
ELECTRICAL AND ELECTRONICS
CURRICULUM

SEMESTER 1										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SHSA1101	Technical English	3	*	0	3	50	50	1
2	Theory	SMTA1101	Engineering Mathematics - I	3	0	0	3	50	50	4
3	Theory	SPHA1101	Physics for Engineers	3	1	0	4	50	50	5
4	Theory	SMEA1102	Engineering Drawing	1	0	4	3	50	50	7
5	Theory	SECA1101	Electronic Devices	3	0	0	3	50	50	8
6	Theory	SCSA1102	Fundamentals of Python Programming	3	0	0	3	50	50	9
7	Practical	SPHA2101	Physics Lab	0	0	2	1	25	25	10
8	Practical	SCSA2102	Fundamentals of Python Programming Lab	0	0	4	2	50	50	11
Total Credits for Semester 1 - 22										
Total Marks for Semester 1 – 750										

SEMESTER 2										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1201	Engineering Mathematics – II	3	0	0	3	50	50	12
2	Theory	SBTA1101	Environmental Science and Engineering	2	0	0	0	-	-	13
3	Theory	SCYA1101	Engineering Chemistry	3	1	0	4	50	50	14
4	Theory	SECA1201	Digital Logic Circuits	3	0	0	3	50	50	15
5	Theory	SEEA1201	Circuit Theory	3	*	0	3	50	50	16
6	Theory	SEEA1202	DC Machines and Transformers	3	*	0	3	50	50	17
7	Practical	SCYA2101	Engineering Chemistry Lab	0	0	2	1	25	25	18
8	Practical	SEEA2201	Electrical Circuits and Electronic Devices lab	0	0	4	2	50	50	19
9	Practical	SEEA2202	DC Machines and Transformers lab	0	0	4	2	50	50	20
Total Credits for Semester 2 – 21										
Total Marks for Semester 2 – 750										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS

CAE – CONTINUOUS ASSESSMENT EXAMINATION,

ESE – END SEMESTER EXAMINATION

SEMESTER 3										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1301	Engineering Mathematics – III	3	*	0	3	50	50	21
2	Theory	SMEA1306	Solid and Fluid Mechanics	3	*	0	3	50	50	22
3	Theory	SECA1305	Electronic Circuits	3	0	0	3	50	50	23
4	Theory	SEEA1301	Network Analysis and Synthesis	3	*	0	3	50	50	24
5	Theory	SEEA1302	Electromagnetic Theory	3	*	0	3	50	50	25
6	Theory	SEEA1303	AC Machines	3	*	0	3	50	50	26
7	Practical	SEEA2301	AC Machines Lab	0	0	4	2	50	50	27
8	Practical	SECA2305	Electronic Circuits Lab	0	0	4	2	50	50	28
Total Credits for Semester 3 – 22										
Total Marks for Semester 3 – 800										

SEMESTER 4										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1401	Engineering Mathematics – IV	3	0	0	3	50	50	29
2	Theory	SCSA1202	Programming with C and C++	3	*	0	3	50	50	30
3	Theory	SMEA1405	Applied Thermodynamics	3	*	0	3	50	50	31
4	Theory	SEEA1401	Power Electronics	3	0	0	3	50	50	32
5	Theory	SEEA1402	Transmission and Distribution	3	*	0	3	50	50	33
6	Theory	SAIC4001	Industry 4.0	2	0	0	2	50	50	34
7	Practical	SCSA2203	Programming in C and C++ Lab	0	0	4	2	50	50	35
8	Practical	SEEA2401	Power Electronics Lab	0	0	4	2	50	50	36
Total Credits for Semester 4 – 21										
Total Marks for Semester 4 – 800										

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CAE – CONTINUOUS ASSESSMENT EXAMINATION,

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SEMESTER 5										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SECA1502	Analog Integrated Circuits	3	0	0	3	50	50	37
2	Theory	SECA1507	Digital Signal Processing and its Applications	3	0	0	3	50	50	38
3	Theory	SECA1508	Microprocessor, Interfacing and Its Applications	3	*	0	3	50	50	39
4	Theory	SEEA1501	Power System Analysis	3	*	0	3	50	50	40
5	Theory	SEEA1502	Control Systems	3	*	0	3	50	50	41
6	Theory		Elective - I	3	0	0	3	50	50	-
7	Practical	SECA2507	Integrated Circuits Lab	0	0	4	2	50	50	42
8	Practical	SECA2508	Microprocessor Lab	0	0	4	2	50	50	43
9	Practical	S14APT1	Professional Training	0	0	3	2	-	100	-
Total Credits for Semester 5 – 24										
Total Marks for Semester 5 – 900										

SEMESTER- 6										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SEEA1601	Electrical Machine Design	3	*	0	3	50	50	44
2	Theory	SEEA1602	Advanced Control Systems	3	*	0	3	50	50	45
3	Theory	SEEA1603	Electrical Drives and Control	3	0	0	3	50	50	46
4	Theory		Elective – II	3	0	0	3	50	50	-
5	Theory		Elective - III	3	0	0	3	50	50	-
6	Practical	SEEA2601	Measurements and Controls Lab	0	0	4	2	50	50	47
7	Practical	SEEA2602	Power Systems Lab	0	0	4	2	50	50	48
8	Practical	S14APT2	Interdisciplinary Project	0	0	6	3	-	100	-
Total Credits for Semester 6 – 22										
Total Marks for Semester 6 – 800										

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CAE – CONTINUOUS ASSESSMENT EXAMINATION,

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SEMESTER 7										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SECA1706	Principles of Embedded System Design	3	*	0	3	50	50	49
2	Theory	SEEA1701	Power System Protection and Switchgear	3	*	0	3	50	50	50
3	Theory		Elective - IV	3	0	0	3	50	50	-
4	Theory		Elective - V	3	0	0	3	50	50	-
5	Theory		Elective - VI	3	0	0	3	50	50	-
6	Practical	SECA2703	Embedded And DSP Lab	0	0	4	2	50	50	51
7	Project	S14APROJ1	Project Phase - 1	0	0	6	3	-	100	-
Total Credits for Semester 7 - 20										
Total Marks for Semester 7 – 700										

SEMESTER 8										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SBAA4002	Principles of Management and Professional Ethics	3	0	0	3	50	50	52
2	Theory	SEEA1801	Special Electrical Machines and Control	3	0	0	3	50	50	53
3	Project	S14APROJ2	Project Phase - 2	0	0	14	7	-	100	-
Total Credits for Semester 8 - 13										
Total Marks for Semester 8 - 300										

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CAE – CONTINUOUS ASSESSMENT EXAMINATION,

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LIST OF ELECTIVE COURSES

PROFESSIONAL ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SEEA3001	Power Generation and Utilization	3	*	0	3	50	50	54
2	SEEA3002	Renewable Energy Systems	3	0	0	3	50	50	55
3	SEEA3003	Power System Operation and Control	3	0	0	3	50	50	56
4	SEEA3004	Flexible AC Transmission System	3	0	0	3	50	50	57
5	SEEA3005	Power System Restructuring and Deregulation	3	0	0	3	50	50	58
6	SEEA3006	Smart Grid	3	0	0	3	50	50	59
7	SEEA3007	High Voltage Engineering	3	0	0	3	50	50	60
8	SEEA3008	Electrical Estimation and Energy Auditing	3	0	0	3	50	50	61
9	SEEA3009	Power Plant Instrumentation	3	0	0	3	50	50	62
10	SEEA3010	Advanced Power Electronics	3	0	0	3	50	50	63
11	SEEA3011	Electric Vehicles	3	0	0	3	50	50	64
12	SEEA3012	Electrical power quality	3	0	0	3	50	50	65
13	SEEA3013	Energy storage systems	3	0	0	3	50	50	66
14	SEEA3014	Industrial instrumentation and automation	3	0	0	3	50	50	67
15	SEEA3015	Testing and commissioning of electrical equipment	3	0	0	3	50	50	68
16	SEEA3016	Embedded systems and IOT	3	0	0	3	50	50	69
17	SEEA3017	Computer Aided Electrical Drawing	3	0	0	3	50	50	70
18	SEEA3018	Industrial Drives and Automation	3	0	0	3	50	50	71
19	SEEA3019	Computer control of electric drives	3	0	0	3	50	50	72
20	SEEA3020	Modern Power Converters	3	0	0	3	50	50	73
21	SEEA3021	Distributed Generation and Microgrids	3	0	0	3	50	50	74
22	SEEA3022	FACTS and HVDC	3	0	0	3	50	50	75
23	SEEA3023	Energy Management and SCADA	3	0	0	3	50	50	76
24	SEEA3024	High Voltage Engineering and HVDC Transmission	3	0	0	3	50	50	78
25	SEEA3025	EHVAC Transmission	3	0	0	3	50	50	80
26	SEEA3026	Smart Grid	3	0	0	3	50	50	81
27	SEEA3027	Green Energy Systems	3	0	0	3	50	50	82
28	SEEA3028	Electric Vehicles	3	0	0	3	50	50	83

29	SEIA1501	Measurements and Instrumentation	3	0	0	3	50	50	84
30	SEIA1603	Biomedical Instrumentation	3	0	0	3	50	50	85
31	SEIA3002	Soft computing Techniques	3	0	0	3	50	50	86
32	SEIA3006	Robotics and Automation	3	0	0	3	50	50	87
33	SECA1602	Programming in HDL	3	0	0	3	50	50	88
34	SECA3007	MEMS and its Applications	3	0	0	3	50	50	89
35	SECA3018	NANO Electronics	3	0	0	3	50	50	90
36	SECA3025	Fundamentals of Communication Engineering	3	0	0	3	50	50	91
37	SECA3026	Fundamentals of Fuzzy Logic and Neural Networks	3	0	0	3	50	50	92
38	SCSA1601	Machine Learning	3	0	0	3	50	50	93
39	SCSA1203	Data Structures	3	0	0	3	50	50	94

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OPEN ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SALA4001	Intellectual Property Law	3	0	0	3	50	50	A1
2	SAEA4001	Fundamentals of Aerospace Technology	3	0	0	3	50	50	A2
3	SBAA4001	Fundamentals of Management	3	0	0	3	50	50	A3
4	SBAA4002	Principles of Management and Professional Ethics	3	0	0	3	50	50	A4
5	SBTA4001	Biology for Engineers	3	0	0	3	50	50	A5
6	SBMA4001	Neurology	3	0	0	3	50	50	A6
7	SBMA4002	Modelling of Physiological Systems	3	0	0	3	50	50	A7
8	SBMA4003	Drug Delivery System	3	0	0	3	50	50	A8
9	SBMA4004	Fundamentals of Mechatronics	3	0	0	3	50	50	A9
10	SBMA4005	Virtuality and Augmented Reality	3	0	0	3	50	50	A10
11	SBMA4006	Medical Optics and Laser Applications	3	0	0	3	50	50	A11
12	SBMA4007	Forensic Science	3	0	0	3	50	50	A12
13	SBMA4008	Artificial Intelligence and Expert Systems	3	0	0	3	50	50	A13
14	SBMA4009	Human Factors in Engineering and Design	3	0	0	3	50	50	A14
15	SCHA4001	Corrosion Engineering	3	0	0	3	50	50	A15
16	SCHA4002	Energy Engineering	3	0	0	3	50	50	A16
17	SCHA4003	Environmental Impact Assessment	3	0	0	3	50	50	A17
18	SCHA4004	Environmental Pollution and Control	3	0	0	3	50	50	A18
19	SCIA4001	Disaster Management	3	0	0	3	50	50	A19
20	SCSA4001	R Programming	3	0	0	3	50	50	A20
21	SCSA4002	5 G Networks	3	0	0	3	50	50	A21
22	SECA4001	Software Tools for Engineering Applications	3	0	0	3	50	50	A22
23	SMEA4001	Resource Management Techniques	3	0	0	3	50	50	A23
24	SMEA4002	Wind and Solar Energy	3	0	0	3	50	50	A24

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CAE – CONTINUOUS ASSESSMENT EXAMINATION,

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Semester	Theory courses (including elective courses)			Practical Courses (including PT and project)		
	Total no.	Total Credits	Total Marks	Total no.	Total Credits	Total Marks
1	6	19	600	2	3	150
2	6	16	500	3	5	250
3	6	18	600	2	4	200
4	6	17	600	2	4	200
5	6	18	600	3	6	300
6	5	15	500	3	7	300
7	5	15	500	2	5	200
8	2	6	200	1	7	100
Overall Total	42	124	4100	18	41	1700

Overall total credits for B.E.ELECTRICAL AND ELECTRONICS	165
Overall total marks for B.E. ELECTRICAL AND ELECTRONICS	5800

SCSA1102	FUNDAMENTALS OF PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand why Python is a useful scripting language for developers.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to build and package Python modules for reusability.
- To learn how to read and write files in Python.
- To learn how to use exception handling in Python applications for error handling.
- To learn how to design and program Python applications.

UNIT1 INTRODUCTION**9Hrs.**

History of Python- Introduction to the IDLE interpreter (shell) -Expressions – Data Types - Built-in function - Conditional statements - Iterative statements- Input/output -Compound Data Types - Nested compound statements – Introduction to Object Oriented Concepts.

UNIT2 FILES AND EXCEPTIONS HANDLING,MODULES,PACKAGES**9 Hrs.**

File Operations –Iterators - Exception handling - Regular Expressions- Creating Modules-Import Statement-Introduction to PIP-Installing Packages via PIP-Using Python Packages.

UNIT3 GUIPROGRAMMING**9Hrs.**

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colours - Canvas - Widgets (frame, label, button, check box, entry, listbox, message, radiobutton, text, spinbox).

UNIT4 DATABASEANDNETWORK**9 Hrs.**

Database (using NoSQL):Connector Module –Cursor – Statements - Exceptions in database.Network connectivity: Socket module - Client – Server – Email – URL Access.

UNIT5 CASESTUDY**9Hrs.**

Web Programming using Python.

Image Processing – Facebook Analysis – Twitter Analysis.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, the student will be able to

CO1 - Develop programs with input, output and conditional statements using Python.

CO2 - Handle effectively data handling types.

CO3 - Design GUI Applications in Python.

CO4 - Develop Client Server network applications using Python.

CO5 - Connect to database package and manipulate the data.

CO6 - Develop solution for real life situational problems.

TEXT / REFERENCE BOOKS

1. Y.Daniel Liang, "Introduction to Programming using python", pearson2013.
2. Paul Gries, Jennifer Campbell, Jason Montojo, "Practical Programming. An Introduction to Computer Science using python 3", pragmatic bookshelf, 21E2014.
3. Magnus Lie Hetland, "Beginning Python: From Novice to Professional" , Apress.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.**

PART A: 10 Questions of 2 marks each -Nochoice

20Marks

PART B: 2 Questions from each unit with internal choice; each carrying 16marks

80Marks

SCSA2102	FUNDAMENTALS OF PYTHON PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To learn the fundamentals of Python programming language.
- To handle and apply the complex type of data.
- To handle and manipulate files.
- To develop GUI based applications.
- To understand various widgets.
- To handle database programming with Python.

SUGGESTED LIST OF EXPERIMENTS

1. Program to handle Input and Output statements.
2. Program using Lists, Tuples, Dictionary and Sets.
3. Program using conditional statements.
4. Program using looping constructs.
5. Program using functions and modules.
6. Program using File handling.
7. Program using Exception handling.
8. GUI Programming using Python - CanvasWidget.
9. GUI Programming using Python - Frame, label, button, check box, entry, list box, message, radio button, text, spinbox.
10. Database Programming using Python.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Develop programs with input, output and conditional statements using Python.
- CO2 - Handle effectively data handling types.
- CO3 - Handle Code reusability using functions and modules.
- CO4 - Handle exception mechanism.
- CO5 - Develop widgets with various controls.
- CO6 - Connect to database package and manipulate the data (CRUD operation).

SECA1201	DIGITAL LOGIC CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge on various types of Binarylogics.
- To design a binary logic circuit for an arithmeticexpressions.
- To understand the usage of registers and counters used in various digitalcircuits.
- To understand the design of memory devicesused.
- To get an exposure about the electronics behind design of Basic digital logicalelements.

UNIT1 NUMBER SYSTEMS, LOGIC FUNCTIONS ANDBOOLEANALGEBRA**9 Hrs.**

Number systems – Number systems conversions - Binary arithmetic – Binary codes – Logic functions-Universal gate functions - Boolean algebra – Functionally complete operation sets, Reduction of switching equations using Boolean algebra, Realization of switchingfunction.

UNIT 2 DESIGN OFCOMBINATIONAL LOGIC**9 Hrs.**

Design procedure of Combinational Logic – Design of two level gate networks - Sum of Products (SOP) - Product of Sums(POS) - Canonical SOP - Canonical POS - Karnaugh Map - Simplifications of Boolean functions using Karnaugh Map and implementation using Logic function – Advantages and limitations of K-Map - Tabulation method - Simplifications of Boolean functions using Tabulation method.

UNIT 3 COMBINATIONALCIRCUITS**9 Hrs.**

Introduction to Combinational circuits – Half Adder, Full Adder - Half Subtractor, Full Subtractor- Parallel binary Adder, Parallel binary Subtractor - Carry look ahead Adder- BCD Adder- Decoders- Encoders - Priority Encoder- Multiplexers- MUX as universal combinational modules- Demultiplexers- Code convertors- Magnitude Comparator.

UNIT 4 SEQUENTIALCIRCUITS**9 Hrs.**

Introduction to Sequential circuits – Flip flops – SR, JK, D and T flip flops, Master Slave flip flop, Characteristic and excitation table – Realization of one flip flop with other flip flops – Registers – Shift registers – Counters – Synchronous and Asynchronous counters – Modulus counters – Ring Counter – Johnson Counter – State diagram, State table, State minimization – Hazards.

UNIT 5 DIGITAL LOGIC FAMILIES, MEMORIES ANDPROGRAMMABLEDEVICES**9Hrs.**

Classification and characteristics of logic family – Bipolar logic family – Saturated logic family – Non saturated family – Unipolar family – MOS, CMOS logic families. Classification and Organization of memories – Programmable Logic Devices – Programmable Logic Array(PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) .

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Analyze various coding techniques and number conversion systems.

CO2 - Develop suitable techniques to minimize the Boolean equations.

CO3 - Design the digital circuit using combinational logic.

CO4 - Design the digital circuit using sequential logic.

CO5 - Analyze the performance of various digital logic families.

CO6 - Solve the arithmetic expressions using memories and programmable logic devices and implement memory units with Programmable logic devices

TEXT / REFERENCE BOOKS

1. John M. Yarbrough, "Digital logic: Applications and Design", Thomas - Vikas Publishing House,2002.
2. Morris Mano, "Digital design-With an Introduction to the Verilog HDL", 5th Edition, Pearson,2013.
3. R.P.Jain, "Modern Digital Electronics", 4th Edition, TMH,2010.
4. Thomas L Floyd, " Digital Fundamentals", 11th edition, Pearson,2015
5. William H. Gothmann, "Digital Electronics", Prentice Hall,2001.
6. Tutorial Website:https://www.tutorialspoint.com/digital_circuits/index.htm.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –Nochoice**20Marks****PART B:** 2 Questions from each unit of internal choice; each carrying16marks**80Marks**

SEEA1201	CIRCUIT THEORY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart sound knowledge in the analysis of electrical circuits.
- To educate the phasor concepts in AC circuits.
- To introduce the knowledge of resonance and transients.
- To impart knowledge of tuned circuits.

UNIT1 D.C.CIRCUITS**9Hrs.**

Electrical quantities, Ohm's Law, Resistors - Series and parallel combinations, Current Division rule, Voltage Division rule, Source transformation - Kirchhoff's laws, Nodal and Mesh Analysis, Star Delta Transformation.

UNIT2 SINGLE PHASE AC CIRCUITS**9Hrs.**

Sinusoidal Functions - RMS(effective) and Average Values - Phasor Representation - J operator – Sinusoidal Excitation Applied to Purely Resistive - Inductive and Capacitive Circuits - RL - RC and RLC Series and Parallel Circuits- Power and Power Factor.

UNIT3 THREE PHASE AC CIRCUITS**9Hrs.**

Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & unbalanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT4 TRANSIENT RESPONSE ANALYSIS**9Hrs.**

Time Domain Analysis - Transient response of RL, RC & RLC Networks with DC Input and Sinusoidal AC input.

UNIT5 RESONANCE AND COUPLED CIRCUITS**9Hrs.**

Series and Parallel resonance - Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Analyze dc circuits by different methods.

CO2 - Determine both magnitude and phase angle for various parameters of single phase AC circuits.

CO3 - Analyze three phase balanced and unbalanced circuits.

CO4 - Apply Laplace transform for time domain circuits.

CO5 - Convert the single tuned & double tuned circuits in to differential equation.

TEXT / REFERENCE BOOKS

1. Mittle B.N., Aravind Mittle, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, July 2017.
2. Charles Alexander, Mathew Sadiku, "Fundamentals of Electric Circuits", Tata McGraw Hill, 6th Edition, 2017.
3. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", PHI Learning Private Ltd, 2nd Edition, 2010.
4. Abhijit Chakrabarti, Sudiptanath & Chandan Kumar Chanda, "Basic Electrical Engineering", Tata McGraw Hill, 1st Edition, 2010.
5. Wadhwa C.L., "Basic Electrical Engineering", New Age International, 4th Edition, 2007, Reprint June 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each – No choice**20Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SEEA1202	DC MACHINES AND TRANSFORMERS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To analyze the electromechanical system.
- To impart knowledge in construction details, principle operation and performance characteristics of DC machines and transformer.
- To evaluate the different losses and performance of DC machines and transformer using different testing methods.
- To analyze the performance characteristics of DC machines.
- To impart knowledge in three phase transformer connection.

UNIT1 MAGNETIC CIRCUITS**9Hrs.**

Definition of MMF, Flux and Reluctance - Leakage Factor - Reluctances in Series and Parallel (Series and Parallel Magnetic Circuits)- Electromagnetic Induction - Fleming's Rule - Lenz's Law - Faraday's laws -statically and dynamically induced EMF- Self and mutual inductance – Analogy of Electric and Magnetic Circuits.

UNIT2 D.C.GENERATORS**9Hrs.**

Constructional Details - Principle of Operation - E.M.F Equation - Methods of Excitation - Types – losses and efficiency- No load and Load characteristics of Series, Shunt and Compound generators - Armature Reaction, Effects, Methods of Compensation – Commutation - Methods of Improving Commutation – Applications.

UNIT3 D.C.MOTORS**9Hrs.**

Principle of Operation - Back E.M.F and Torque Equation - Characteristics of Series, Shunt & Compound Motors -Starters - Speed Control of DC Series & Shunt Motors - Testing of DC Machines - Brake Test, Swinburne's Test & Hopkinson's Test.

UNIT4 SINGLE PHASE TRANSFORMER**9Hrs.**

Principle of Operation - Constructional Details - E.M.F. Equation - Transformation Ratio - losses and efficiency – Transformer on No Load - Parameters Referred to HV / LV Windings - Equivalent Circuit - Transformer On Load - Phasor diagram-Regulation-Testing of Transformer -Open Circuit and Short Circuit Test-All day Efficiency-Sumpner's Test..

UNIT5 THREE PHASE AND SPECIAL TRANSFORMERS**9Hrs.**

Auto Transformer - Saving of copper in comparison with Two winding Transformer - Parallel Operation of Single Phase Transformers - Construction of Three Phase Transformer - Transformer Connections – Scott connection - Three Phase to Single Phase Transformer conversion - Elementary Ideas on Instrument Transformers and Toroidal Transformer.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Apply the magnetic circuit concept to electrical machines.
- CO2 - Examine the performance of DC generator.
- CO3 - Analyze the testing methods to determine the performance of DC motor.
- CO4 - Evaluate the performance of a single- phase transformer.
- CO5 - Determine the amount of copper saved in auto transformer.
- CO6 - Investigate the transformer connection for various applications.

TEXT / REFERENCE BOOKS

1. A K Theraja & B L Thereja, "A Text book of Electrical Technology (Vol II)", S Chand & Co- 23rd Edition 2008.
2. I J Nagrath and D P Kothari, "Electrical Machines", Tata McGraw Hill Publishing Company Limited New Delhi, 3rd Edition, 2007.
3. R.K.Rajput, "Electrical Machine", Laxmi Publications, 5th Edition 2008.
4. S K Sen, "Electrical Machinery", Khanna Publishers, New Delhi, Reprint 2002.
5. John Hindmarsh, U.M.I.S.T England, "Electrical Machines & their applications", Pergamon, 4th edition 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –No choice**20Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SEEA2201	ELECTRICAL CIRCUITS AND ELECTRONIC DEVICES LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To know the usage of Electrical and Electronic equipment.
- To know the testing of components.
- To understand the transient and resonance circuits.
- To understand the PN diode operation in forward and reverse bias.
- To know the characteristics of transistor in CB, CE configurations.

SUGGESTED LIST OF EXPERIMENTS**Electrical Circuits Lab**

1. Verification of Kirchhoff's Law.
2. Verification of Theorems.
3. Series and Parallel AC circuits.
4. R-L and R-C transients with DC transients.
5. Series and Parallel Resonance.
6. Clippers and Clampers.

Electronic Devices Lab

1. Characteristics of Semiconductor diode and Zener diode to find static and dynamic resistance from the characteristics.
2. Characteristics of CB configuration.
3. Characteristics of CE configuration.
4. Drain and transfer characteristics of JFET. To obtain gain, trans conductance and amplification factor.
5. Characteristics of SCR, find holding current, break over voltage and holding voltage.
6. Characteristics of UJT, find intrinsic standoff ratio, Peak voltage and valley voltage.
7. Characteristics of LDR with illumination and without illumination.
8. Voltage multipliers.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Examine waveforms using function generator and measure voltage, frequency and phase of any waveform using CRO
- CO2 - Apply various electrical components to verify Kirchhoff's Law.
- CO3 - Apply laws to verify various theorems.
- CO4 - Analyze the performance of transients and resonance circuits.
- CO5 - Analyze the characteristics of different electrical and electronic devices such as diodes, transistors etc.
- CO6 - Design and verify the characteristics of different electronic circuits like rectifiers, amplifiers etc.

SEEA2202	DC MACHINES AND TRANSFORMERS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To impart knowledge to conduct test on various types of machines and transformer.
- To practice different types of wiring and apparatus connection.
- To analyze the operation of various DC machines with different load condition.
- To obtain the characteristics of DC machines and transformer by performing suitable test.

SUGGESTED LIST OF EXPERIMENTS

- 1 OCC and load characteristics of self- excited DC shunt generator.
- 2 OCC and load characteristics of separately excited DC shunt generator.
- 3 Load characteristics of DC series generator.
- 4 Load characteristics of DC compound generator (Differential and Cumulative).
- 5 Load characteristics of DC shunt motor.
- 6 Load characteristics of DC series motor.
- 7 Load characteristics of DC compound motor (Differential and Cumulative).
- 8 Speed control of DC shunt motor.
- 9 Swinburne's test on DC shunt motor.
- 10 Hopkinson's test.
- 11 OC and SC test on Single Phase Transformer.
- 12 Load test on Single Phase Transformer.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze the internal, external and efficiency characteristics of various types of DC generators.

CO2 - Analyze the electrical and mechanical characteristics of various types DC motors.

CO3 - Predict the efficiency in a DC Machine.

CO4 - Determination the efficiency of a Single- Phase Transformer.

CO5 - Deduce the electrical equivalent circuit parameters of a Single- Phase Transformer.

CO6 - Demonstrate the various speed control operations of a DC motor...

SAIC4001	INDUSTRY 4.0	L	T	P	Credits	Total Marks
		2	0	2	2	100

UNIT 1 ADVANCED TECHNOLOGY AND MATERIALS**7 Hrs.**

Advanced electro-optical sensing technology-active, passive multi-spectral and hyper spectral imaging; electronic beam steering; vacuum technology, surface and coating technology, health care technology, Nanotechnology- Nanomechanics, Nano optoelectronics; energy storage technology-next generation Li-based Batteries, Hydrogen storage, solar photovoltaic's, Flexible electronics. Intellectual Property Rights - case studies governing/pertaining to Materials/Technology.

UNIT 2 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING**7 Hrs.**

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Case studies – Intellectual Property rights infringement in Biology.

UNIT 3 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT**7 Hrs.**

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal, public health issues-improving water management in surface and overhead irrigation- Integration of energy, water and environmental systems for a sustainable development.

UNIT 4 SMART MANUFACTURING**8 Hrs.**

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations – Intellectual Property Rights (IPR): Case Studies.

UNIT 5 SMART WORLD**8 Hrs.**

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Intellectual Property Rights- Case Studies.

UNIT 6 CYBER PHYSICAL SYSTEMS**8 Hrs.**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : CaseStudies.

Max. 45 Hrs.**TEXT / REFERENCE BOOKS**

1. William D. Callister, "Materials Science and Engineering, An Introduction, John Wiley and Sons Inc. Singapore, 2001.
2. V. Raghavan, "Physical Metallurgy: Principle and Practice. Prentice Hall India Pvt Ltd, 2006.
3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol. 103, pp. 251-267, 2019.
3. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
4. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Studylab Publications, 2016.
5. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A :** 11 Questions of 2 marks each-No choice**PART B :** 2 Questions from each unit with internal choice, each carrying 13 marks**Exam Duration: 3 Hrs.****22 Marks****78 Marks**

SECA1305	ELECTRONIC CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To familiarize the student with the design and analysis of Rectifiers and powersupplies.
- To understand different Transistor biasingcircuits.
- To understand Small signal analysis of FET and MOSFET amplifiers.
- To understand working of feedback amplifiers, oscillators, tuned amplifiers andmultivibrators.

UNIT1 RECTIFIERS ANDPOWERSUPPLIES**9Hrs.**

Half Wave Rectifier - Full Wave Rectifier - Bridge Rectifier - Performance of Rectifiers - Filters - Types of Filters - L, C, LC and π Filters - Ripple Factor Calculation for C, L, LC and π Filter - Regulators - Shunt and Series Voltage Regulator - SMPS.

UNIT2 SMALLSIGNALAMPLIFIERS**9Hrs.**

Biasing circuit of BJT, DC equivalent circuit of BJT, DC and AC Load Lines, Stability factor analysis, Two port devices and hybrid model - transistor hybrid model and h parameters - determination of h-parameters from the characteristics - Analysis of transistor amplifier using h -parameters - Low frequency FET model - Common Source and Common drain amplifiers.

UNIT3 MULTI STAGE AMPLIFIERS AND LARGESIGNALAMPLIFIERS**9Hrs.**

Cascading amplifiers - direct coupled and capacitor coupled two stage CE amplifiers - Darlington Pair - Cascode Amplifier - Bootstrap amplifier - Classification of Power amplifiers - Class A Power Amplifier - direct and Transformer coupled amplifiers - Class B Push-pull arrangements and Complementary symmetry amplifiers - efficiency calculations, Amplifier distortion, power dissipation - Class AB amplifier - Power transistor heat sinking - Class C and D amplifiers.

UNIT4 FEEDBACK AMPLIFIERS AND OSCILLATORS**9Hrs.**

Feedback Amplifiers: Feedback concept - General characteristics of negative feedback amplifiers - Four basic types of feedback topologies - Voltage and current feedback amplifiers. **Oscillators: Barkhausen criterion - LC oscillators - Analysis of Hartley, colpitts - RC oscillators - Phase shift and wein bridge types and analysis - Crystal oscillators and frequency stability.**

UNIT5 TUNED AMPLIFIERS AND MULTIVIBRATORS**9Hrs.**

Tuned Amplifiers - single tuned - double tuned - stagger tuned amplifiers - Instability of Tuned Amplifier - Neutralization and Unilateralization - Multivibrators - Collector coupled Astable, Monostable and Bistable Multivibrators.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Analyze the equivalent circuits and characteristics of basic electronics devices.

CO2 - Analyze basic linear electronics circuits and their working principle.

CO3 - Design suitable DC Power supplies for world.

CO4 - Design suitable multistage amplifiers for real world.

CO5 - Design negative feedback amplifier circuits and oscillators.

CO6 - Analyze various solid state power amplifier circuits.

TEXT / REFERENCE BOOKS

1. S Millman and Halkias, "Integrated Electronics", Tata McGraw Hill International, 2008.
2. R.L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", PHI Learning Pvt. Ltd, India, 9th edition, 2008.
3. D.Roy Choudhury & Shail B Jain, "Linear Integrated Circuits", 3rd edition, 2007.
4. David. A. Bell, "Electronic Devices and Circuits", PHI Learning Private Ltd, India, 4th edition 2008.
5. R.A. Gayakwad, "Op-Amps and Linear integrated circuits", PHI, 2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –No choice**20Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SEEA1301	NETWORK ANALYSIS AND SYNTHESIS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart knowledge in design of the any two port network.
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practices.
- To have knowledge in synthesis of any network knowing the stability of the system.
- To give the students a fair knowledge on the networks.

UNIT1 NETWORK THEOREMS (BOTH DC AND AC)**9Hrs.**

Superposition Theorem - Reciprocity Theorem - Thevenin's Theorem - Norton's Theorem - Maximum Power Transfer Theorem.

UNIT2 NETWORK FUNCTIONS AND ITS PARAMETERS**9Hrs.**

Network Functions - Driving Point Impedance - Transfer Functions - Poles and Zeros, Significance of Poles and Zeros - Determination of Network Function of One Port and Two Port Network - Network Parameters - Z, Y, h and ABCD- Conditions for Reciprocity - Parameter Conversion.

UNIT3 TWO PORT NETWORKS**9Hrs.**

Image Parameters - Iterative Parameter - Image and Iterative Parameters in terms of Open Circuit and Short Circuit Network - Parameters of Important Networks - Lattice Network - T Network, π Network - Twin Network - Network Conversions.

UNIT4 SYNTHESIS OF LC, RL AND RC NETWORK**9Hrs.**

Hurwitz polynomial - Positive Real function - Elementary Synthesis Procedure - Properties of LC, RC, and RL Driving Point Functions - Synthesis of LC, RC, RL and RLC Network using Foster and Cauer Forms.

UNIT5 NETWORK TOPOLOGY**9Hrs.**

Network Topology - Basic concepts of Graph Theory, Network Graph, Tree, Incidence & Reduced Incidence Matrices, Cut sets, Tie sets, Cut Set Schedule, Tie set Schedule - Duality and Dual Networks.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Analyze various electrical circuits using suitable electrical theorem.

CO2 - Determine the transfer function for various electrical circuits.

CO3 - Analyze various types of two port networks.

CO4 - Synthesize different electrical circuit's real world problem.

CO5 - Analyze the electrical circuits by graphical method.

CO6 - Generate matrix for any electrical circuits.

TEXT / REFERENCE BOOKS

1. A Sudhakar Shyam Mohan S Palli, "Circuits and Networks Analysis and Synthesis", 5th Mc Graw Hill Education (India) Pvt. Ltd, 2015.
2. M.E. Van Valkenburg, "Network Analysis", 4th edition, Pearson Education Pvt. Ltd, 2015.
3. Hayt W.H., Kemmerly J.E. and Durbin S.M., "Engineering Circuit Analysis", 6th Ed., Tata McGraw-Hill Publishing Company Ltd., 2008.
4. Kuo F.F., "Network Analysis and Synthesis", 2nd Ed., Wiley India, 2008.
5. Isaak Mayergoyz W. Lawson, "Basic Electric Circuit Theory", 1st Edition, Elsevier, 2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3Hrs.**

PART A: 10 Questions of 2 marks each – No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SEEA1302	ELECTROMAGNETIC THEORY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To be familiar with some elementary phenomena and concepts in field theory.
- Acquire knowledge on the concepts of Electro-magnetic field which is essential for understanding the working principle, design and analysis of Electrical machines.
- Can derive, formulate and solve field problems with the help of static and dynamic fields and potentials and use them for electrical systems.
- Analyse the electromagnetic wave propagation using Maxwell's equations, derive Poynting theorem and interpret the physical meaning.

UNIT1 ELECTRIC FIELDS**9Hrs.**

Introduction - Concepts of Different Co-Ordinate Systems - Coulomb's Law, Electric Field Intensity, Electric Field due to Point Charge, Line Charge, Surface Charge and Volume Charge Distributions - Electric Flux Density - Gauss Law - Application of Gauss Law - Electric Potential - Potential Gradient - Divergence and Divergence Theorem - Poisson's and Laplace equation.

UNIT2 CONDUCTORS AND DIELECTRICS**9Hrs.**

Field due to Dipoles - Dipole Moment - Boundary Conditions at Dielectric and Conductor Surfaces - Capacitor and Capacitance of a System of Conductors - Energy Stored and Energy Density - Capacitance due to Spherical Shell, Coaxial cable and Two Wire Transmission Line - Electrostatic Potential Energy Associated with Different Charges.

UNIT3 MAGNETIC FIELDS**9Hrs.**

Current and Current Density - Conduction and Convection Current - Force on a Current Element - Biot-Savart's law - Force between Current Carrying Conductors - Torque on Closed Conductors - Ampere's Law - Magnetic Flux Density - Curl and Stokes Theorem - Magnetic Vector Potential - Boundary Condition at the Magnetic surfaces.

UNIT4 FARADAY'S LAW OF ELECTROMAGNETIC INDUCTION**9Hrs.**

Faradays' Laws - Self and Mutual Inductance - Inductance of Solenoids, Toroids, Transmission Lines and Cables - Energy Stored and Density in Magnetic Circuits.

UNIT5 MAXWELL'S EQUATION AND ELECTROMAGNETIC WAVES**9Hrs.**

Concept of Displacement and Conduction Current - Modified Ampere's Circuital Law - Maxwell's Equations in point and Integral Forms - Wave Equations - Plane Waves in Free Space - Polarization - Poynting's Theorem and Poynting Vector and its Significance - Energy in Electromagnetic Field.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Apply the various laws used in electromagnetic fields.
- CO2 - Analyze the various quantities in electric and magnetic field.
- CO3 - Apply different co-ordinate Systems for the various fields.
- CO4 - Analyze electric field and magnetic field qualities at different boundaries.
- CO5 - Evaluate the parameters using laws of electromagnetics.
- CO6 - Design Solenoids, Toroids, Transmission Lines and Cables etc.

TEXT / REFERENCE BOOKS

1. K.A. Gangadhar, "Electromagnetic Field Theory (Including Antenna Wave Propagation)", Khanna Publisher New Delhi, 2009.
2. Karl.E.Lonngrén, Sava.V.Savov, "Fundamentals of Electromagnetics with MATLAB", PHI, 2005.
3. William Hayt, "Engineering Electromagnetics", Tata McGraw - Hill, New York, 8th Edition, 2017.
4. R.Meenukumari & R.Subasri, "Electromagnetic Fields", New Age International Publishers, 2nd Edition, 2007.
5. E.C.Jordan & K.G.Balmain, "Electromagnetic Waves & Radiating Systems", Prentice Hall, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –No choice**20Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SEEA1303	AC MACHINES	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart knowledge on Construction and principle operation of Asynchronous and Synchronous machines.
- To impart knowledge on not self-starting AC machines.
- To convey knowledge on speed control of three-phase induction motors.
- To analyze performance characteristics of Synchronous and Asynchronous machines.
- To convey knowledge on synchronized operation of an Alternator with an Infinite busbar.

UNIT1 SYNCHRONOUS GENERATORS**10Hrs.**

Constructional features - EMF Equation - Armature Reaction - Synchronous Reactance - Voltage Regulation - Synchronous Impedance Method - MMF and Potier Methods - Synchronising & Parallel Operation - Two Reaction Theory - Determination of X_d and X_q (Slip test).

UNIT2 SYNCHRONOUS MOTORS**9Hrs.**

Principle of Operation - Starting Methods - Effect of Increased Load with Constant Excitation - Effect of Changing Excitation on Constant Load - Different Torque - Power flow equation - Phasor diagram - V and inverted V curves - Hunting and suppression methods.

UNIT3 THREE PHASE INDUCTION MOTORS**9Hrs.**

Construction - Types of 3- Phase Induction Motors - Rotating Magnetic Fields - Torque Equation - Condition for Maximum Torque - Slip, Torque Slip Characteristics - Power Stages in Induction Motors - Losses and Efficiency - Plugging - Cogging and Crawling - Concept of Induction Generator.

UNIT4 CIRCLE DIAGRAM AND CONTROL METHODS OF 3- PHASE INDUCTION MOTOR**9Hrs.**

No load and Blocked rotor tests - Equivalent circuit - Construction of Circle diagram - Starting methods - Speed control - Double cage Induction motor.

UNIT5 SINGLE PHASE AC MOTORS**8Hrs.**

Double Field Revolving Theory - Types of Single- Phase Induction Motor - Equivalent Circuit (Qualitative) - Repulsion Motor - Series Motor - Universal motor, AC Servomotor, Linear Induction Motor, Hysteresis motor.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Apply relevant principles to predetermine the regulation of a Synchronous Generator.
- CO2 - Analyze the operation of synchronous motor under various excitation conditions.
- CO3 - Analyze the performance of three phase induction motor.
- CO4 - Realize the various methods of starting and testing of three phase induction motor.
- CO5 - Analyze the equivalent circuit of single- phase induction motor.
- CO6 - Select a suitable AC motor for particular application.

TEXT / REFERENCE BOOKS

1. A K Theraja & B L Thereja, "A Text book of Electrical Technology (Vol II)", S Chand & Co., 23rd Edition 2008.
2. D.P. Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill Publishing Company Ltd, 2002.
3. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata Mc Graw Hill Publishing Company Ltd, 2003.
4. M.N. Bandyopadhyay, "Electrical Machines Theory and Practice", PHI Learning Pvt. Ltd., New Delhi, 2009.
5. Charles A. Gross, "Electric / Machines", CRC Press, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –No choice**20Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SEEA2301	AC MACHINES LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- Acquire knowledge about the construction details of Synchronous and Asynchronous machines.
- To impart knowledge on self-starting methods of AC machines.
- To convey knowledge on Starting of three-phase induction motors.
- To analyze the operation of various Asynchronous machine with different load condition.
- To obtain the characteristics of Synchronous and Asynchronous machines by performing suitable test.

SUGGESTED LIST OF EXPERIMENTS

1. Regulation of Alternator by EMF and MMF method.
2. Regulation of Alternator by Potier method.
3. Regulation of salient pole Alternator by slip test.
4. Load test on 3 Phase Alternator.
5. Synchronizing and parallel operation of three phase Alternator with infinite busbar.
6. V curve and inverted V curves of synchronous motor.
7. Brake load test on three phase squirrel cage induction motor.
8. Load test on three phase Slip ring Induction motor.
9. Load test on Single phase Induction motor.
10. Equivalent circuit of Single phase Induction motor.
11. Circle diagram and performance of three phase Induction motor.
12. Study on characteristics of Induction generator.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Evaluate the voltage regulation of alternator with different indirect method.
- CO2 - Analyze the voltage regulation of alternator with various load.
- CO3 - Develop the synchronization circuit for alternator.
- CO4 - Analyze the performance characteristics of Induction motor.
- CO5 - Examine performance characteristics of single- phase induction motor.
- CO6 - Analyze the characteristics of asynchronous machine.

SECA2305	ELECTRONIC CIRCUITS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To illustrate the students different electronic circuit and their application in practice.
- To impart knowledge on assessing performance of electronic circuit through monitoring of sensitive parameters.
- To evaluate the use of computer based analysis tool to review performance of semiconductor device circuit.

SUGGESTED LIST OF EXPERIMENTS

1. Determination of Ripple factor, % Regulation of HWR with and without filter.
2. Determination of Ripple factor, % Regulation of FWR with and without filter.
3. Design of series voltage regulator and perform line and load regulation.
4. Design of various Biasing techniques for CE amplifier.
5. Design and construct BJT Common Emitter Amplifier using voltage divider bias (self-bias) with and without bypassed emitter resistor.
6. Darlington Amplifier using BJT.
7. Differential amplifier using BJT.
8. Design of RC Phase shift oscillator for a specified frequency.

SIMULATION USING PSPICE

1. Frequency response of BJT Common Emitter Amplifier.
2. Frequency response of BJT Common Base Amplifier.
3. Frequency response of JFET Common Source Amplifier.
4. Time response of Astable Multivibrator, Mono stable Multivibrator and Bistable Multivibrator.
5. Frequency response of Class A Power Amplifier.
6. Frequency response of Series and Shunt Feedback amplifier.
7. Time response of Hartley, Colpitts Oscillator.
8. Time and frequency response of Single Tuned Amplifier.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze the performance characteristics of rectifiers circuits with and without filters.

CO2 - Examine the operation of amplifier circuits under different operating conditions.

CO3 - Apply various design techniques to the transistor amplifier circuits.

CO4 - Examine the theoretical and practical values for various semiconductor devices.

CO5 - Analyze the characteristics of different electronic circuits like rectifiers, amplifiers, Oscillators, etc.,

CO6 - Design the amplifier and oscillator circuits using Spice.

SCSA1202	PROGRAMMING WITH C AND C++	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To learn the fundamental programming concepts and methodologies which are essential to building good C/C++ program.
- To demonstrate a thorough understanding of modular programming by designing programs which require the use of programmer-defined functions.
- To impart the knowledge about pointers which is the backbone of effective memory handling.
- To demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.

UNIT1 BASICS OF C PROGRAMMING**9 Hrs.**

Introduction to C: Features of C - Structure of C program-Data Types-'C' Tokens-Input/output statements-Control Statement, Functions: – Types of Functions – Recursion.

UNIT2 ARRAYS, STRINGS AND STRUCTURES**9 Hrs.**

Arrays : Single and Multidimensional Arrays— Array as Function Arguments, Strings: String Handling Functions, Structure: Nested Structures – Array of Structures – Structure as Function Argument–Function that Returns Structure, Union.

UNIT3 POINTERS AND FILE PROCESSING**9 Hrs.**

Pointers: Introduction, Arrays Using Pointers – Structures Using Pointers – Functions Using Pointer, Dynamic Memory Allocation, Storage Classes, File Handling in 'C'.

UNIT4 OBJECT ORIENTED PROGRAMMING CONCEPTS**9 Hrs.**

Introduction-Procedure vs. object oriented programming-Concepts: Classes and Objects-Operator & Function Overloading-Inheritance-Polymorphism and Virtual Functions.

UNIT5 TEMPLATES AND EXCEPTION HANDLING**9 Hrs.**

Function Templates and Class Templates – Name spaces – Standard Template Library - Casting – Exception Handling – case study.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, the student will be able to

- CO1 - Develop simple applications in C using basic constructs.
- CO2 - Design and Implement applications using arrays and strings.
- CO3 - Develop and Implement applications using memory allocation and File concepts.
- CO4 - Apply proper class protection to provide security.
- CO5 - Examine the reusability of code through Inheritance.
- CO6 - Analyze virtual functions to implement polymorphism.

TEXT / REFERENCE BOOKS

- Deitel and Deitel, "C how to Program", 7th Edition, Pearson Education, 2013.
- Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education, 2015.
- Yashavant Kanetkar, "Understanding Pointers in C", 4th Revised & Updated Edition, Bbp Publications, 2008.
- E Balagurusamy, "Object Oriented Programming with C++", 3rd edition, Tata McGraw Hill, 2006.
- Bhave, "Object Oriented Programming with C++", Pearson Education, 2004.
- John R Hubbard, "Programming with C++", Schaums Outline Series, McGraw Hill, 2nd edition, 2009.
- Bjarne Stroustrup, "Programming: Principles and Practice using C++", 1st Edition, Addison Wesley Publications, 2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each – No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SEEA1401	POWER ELECTRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge on different types of power semiconductor devices and its switching characteristics.
- To study the operation, characteristics and performance parameters of controlled rectifiers.
- To understand the operations of choppers and inverters.
- To get acquainted with the applications of power electronics converters.

UNIT1 POWER SEMICONDUCTOR DEVICES**9Hrs.**

Overview of V-I characteristics of switching devices - Switching characteristics of Power Diode, Power BJT, Power MOSFETS, IGBT and Thyristor - SCR Protection circuits - Thyristor Turn-ON methods - Firing circuits - Commutation techniques.

UNIT2 PHASE CONTROLLED RECTIFIERS**10 Hrs.**

Principle of phase controlled converter operation - single phase half wave converter, semi converter & full converter with R, RL & RLE load - Freewheeling diode - Inverter operation of full converter - Three phase Semi converter & full converter with RL load.

UNIT3 DC & AC CHOPPERS**9Hrs.**

DC - DC: Principle of operation of Step down and step up choppers - Control Strategies - One, Two and Four quadrant operation. AC - AC Chopper: Single phase AC voltage controllers with R & RL load - Multistage sequence control. Single phase step up and step down cycloconverters.

UNIT4 INVERTERS**9Hrs.**

Principle of operation: Single phase half bridge & full bridge voltage source inverters – Series Inverters – Parallel Inverters. Three phase Voltage source inverters (120° and 180° mode) - Single phase current source inverter. PWM techniques: Single pulse PWM, Sinusoidal PWM, Modified sinusoidal PWM and multiple PWM.

UNIT5 APPLICATIONS**8Hrs.**

SMPS: Flyback and Push Pull - UPS: Redundant and Non-Redundant - HVDC Transmission systems – DC – DC converters for Electric Vehicles - Inverters for standalone photovoltaic systems.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Examine the V – I and Switching Characteristics of various Semiconductor Devices.

CO2 - Evaluate the various performance parameters of different converters.

CO3 - Analyze different Chopper Circuits.

CO4 - Design various Inverters based on real time applications.

CO5 - Analyze the Knowledge acquired in Power Electronics for High voltage applications.

CO6 - Design Power Electronic Converters to enhance the performance of Renewable Energy sources.

TEXT / REFERENCE BOOKS

1. Rashid M.H., "Power Electronics circuits Devices and Applications", Prentice Hall, 3rd Edition, New Delhi, 2013.
2. P.S.Bimbhra, "Power Electronics", Khanna Publishers, 4th Edition, 2017.
3. P.C.Sen, "Power Electronics", Tata Mc Graw Hill Company, New Delhi, 2015.
4. M.D.Singh and K.B.Khanchandani, "Power Electronics" TMH, New Delhi, 2nd Edition, 2008.
5. Ned Mohan, Tore .M. Undel and William P. Robbins "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 3rd Edition, 2003.
6. Philip T. Kerin, "Elements of Power Electronics" Oxford University Press, 2004 Edition.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –No choice**20Marks****PARTB:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SEEA1402	TRANSMISSION AND DISTRIBUTION	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart knowledge about the fundamental concepts of electrical power transmission & distribution, both AC & DC and busbar arrangements.
- To interpret the transmission line parameters and performance of overhead transmission system.
- To have a knowledge on insulators and cables.
- To introduce the need of FACTS technology and high voltage AC and DC transmission.

UNIT1 STRUCTURE OF ELECTRIC POWER SYSTEM**10 Hrs.**

Single Line Diagram - Distributors with Concentrated and Uniform Loading - DC Two Wire and Three Wire Systems - AC Distributors - Radial and Ring Distributors - Interconnectors - **Electrical Layout & Bus Bar Arrangement in Generating Sub Stations and Bulk Power Substation - Kelvin's Law for the Design of Feeders and its Limitations.**

UNIT2 TRANSMISSION LINE PARAMETERS**9Hrs.**

Resistance, Inductance and Capacitance of Single Phase and Three Phase (Including Double Circuits) Transmission Lines - Stranded and Bundled Conductors - Symmetrical and Unsymmetrical Spacing - Transposition - Application of Self and Mutual GMD - Skin and Proximity Effect - Inductive Interference with Neighboring Circuits - Corona - Factors Affecting Corona - Advantages and Disadvantages of Corona - Methods of Reducing Corona Effect.

UNIT3 PERFORMANCE OF TRANSMISSION LINES**9Hrs.**

Equivalent Circuits for Short, Medium (π and T circuits) and Long Lines - Efficiency and Regulation - Attenuation Constant, Phase Constant, Surge Impedance and Surge Impedance Loading - Real and Reactive Power Flows in Lines - Power Circle Diagrams for Receiving and Sending Ends - Ferranti Effect.

UNIT4 INSULATORS, CABLES AND MECHANICAL DESIGN OF OH LINES**9Hrs.**

Insulators - Types and Construction - Voltage Distribution in String Insulator - string Efficiency - Methods of Improving String Efficiency - Cables - types - Capacitance of Cables - Insulation Resistance - Dielectric Stress and Grading - Dielectric Loss - Thermal Characteristics - capacitance of Three Core Cables - Stress and Sag Calculations - Effect of Wind and Ice - Supports at Different Levels - stringing Chart.

UNIT5 RECENT TRENDS IN TRANSMISSION**8Hrs.**

Extra High Voltage AC (EHVAC) Transmission - Need, Advantages, Limitations - High Voltage Direct current Transmission (HVDC) - Terminal Equipment for HVDC Systems - Classifications, Advantages, Limitations - Economic Distance for HVDC - Comparison of EHVAC and HVDC Transmission - Interconnection of HVDC & AC Systems - Voltage Control of Lines - Introduction to FACTS Technology - SVC, TCSC, STATCOM, UPFC.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Apply basic circuit knowledge on calculating voltage-current for transmission and distribution system.
- CO2 - Evaluate transmission line parameters for single and three phase system.
- CO3 - Analyze the performance of over head transmission line.
- CO4 - Design the overhead transmission line on mechanical aspect and estimate the performance parameters of line insulator and cables.
- CO5 - Develop compensation techniques for transmission line using FACTS devices.
- CO6 - Examine the economic aspects of high voltage transmission (AC and DC).

TEXT / REFERENCE BOOKS

1. C.L. Wadhwa, "Electrical Power Systems", 6th Edition, New Age International (P) Limited, New Delhi, 2010.
2. V.K. Metha & Rohit Metha, "Principles of Power System", S. Chand, 3rd Edition, 2006.
3. S.L. Uppal, Electrical Power, Khanna Publishers, New Delhi, 2006.
4. Chakrabarti A., Soni M.I., Gupta P.V., "Textbook on power system engineering", Dhanpat Rai & Co., 2008.
5. S.N. Singh, "Electric Power Generation, Transmission & Distribution", Prentice Hall of India, New Edn, New Delhi, 2008.
6. Soni, Bhatnagar and Gupta, "Electrical Power", Dhanpat Rai & Sons, New Delhi, 2006.
7. Colin R. Bayliss, Brian Hardy, 4th Edition, "Transmission and Distribution Electrical Engineering", Newnes, 2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each – No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SEEA1403	INDUSTRY 4.0 For ELECTRICAL ENGINEERS	L	T	P	Credits	Total Marks
		2	0	0	2	100

COURSE OBJECTIVES

- To impart basic idea in Industry 4.0.
- To provide students with good depth of knowledge of designing Industrial 4.0 Systems for various application.
- Learn the design and analysis of Industry 4.0 systems for Energy and smart vehicular applications.

UNIT1 INTRODUCTION TO INDUSTRY 4.0**9 Hrs.**

Introduction, Historical Context, General framework, Application areas, Dissemination of Industry 4.0 and the disciplines that contribute to its development, Artificial intelligence, The Internet of Things and Industrial Internet of Things, Additive manufacturing, Robotization and automation, Current situation of Industry 4.0. Introduction to Industry 4.0 to Industry 5.0 Advances.

UNIT 2 INDUSTRY 4.0 AND CYBER PHYSICAL SYSTEM**9Hrs.**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation. Case study: Application of CPS in health care domain.

UNIT 3 SMART ENERGY SOURCES**9Hrs.**

Energy Storage for Mitigating the Variability of Renewable Electricity Sources- Types of electric energy storage, Potential of Sodium-Sulfur Battery Energy Storage to Enable Integration of Wind-Case study. Electric Vehicles as Energy Storage: V2G Capacity Estimation.

UNIT4 SMARTGRID**9 Hrs.**

Smart grid definition and development Smart Grid, Understanding the Smart Grid, Smart grid solutions, Design challenges of smart grid and Industry 4.0, Building the Smart Grid-Case study.

UNIT 5 SMART APPLICATIONS**9 Hrs.**

Understanding Smart Appliances -Smart Operation-Smart Monitoring-Smart Energy Savings-Smart Maintenance, Case study-Smart Cars, Self-Driving Cars, Introducing Google's Self-Driving Car, Intellectual Property Rights.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Understand the basic concepts of Industry 4.0 and the other related fields.

CO2 – Understand cyber physical system and the emerging applications.

CO3 - Analyze the different energy storage systems

CO4 - Analyze a smart grid system.

CO5 – Implement the industry 4.0 to solve engineering problems.

CO6 – Design of smart vehicle and analyze its performance.

TEXT / REFERENCE BOOKS

1. Jean-Claude André, — Industry 4.0II, Wiley- ISTE, July 2019, ISBN: 781786304827,2019.
2. Diego Galar Pascual, Pasquale Daponte, Uday Kumar, —Handbook of Industry 4.0 and SMART SystemsII Taylor and Francis,2020.
3. Miller M, — The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the worldII, Pearson Education, 2015, ISBN: 9780134021300. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA,2017.
4. Pengwei Du and Ning Lu, —Energy storage for smart grids: planning and operation for renewable and variable energy resources VERs II, Academic Press, 2018, Reprint edition, ISBN-13: 978-0128100714.
5. Hossam A. Gabbar, — Smart Energy Grid EngineeringII, Academic Press, 2017, ISBN 978-0-12- 805343-0..
6. Mini S. Thomas, John Douglas McDonald, —Power System SCADA and Smart GridsII, CRC Press, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –Nochoice**20Marks****PARTB:**2Questionsfromeachunitofinternalchoice;eachcarrying16marks**80Marks**

SCSA2203	PROGRAMMING IN C AND C++ LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To understand the basic concepts of C/C++ programming.
- To demonstrate the techniques for implementing engineering applications using computer programs.
- To equip students with sound skills in C/C++ programming language.
- To Identify, formulate and solve problems by using computer programming language.
- To write diversified solutions using C language.

SUGGESTED LIST OF PROGRAMS

1. Programs using Control Statements.
2. Programs using Arrays and Functions.
3. Programs using Structures and Union.
4. Programs using Dynamic Memory Allocation.
5. Programs using Files.
6. Programs using Class and Objects.
7. Programs using Constructor and Destructor.
8. Programs using Function & Operator overloading.
9. Programs using Virtual Functions.
10. Programs using Inheritance.

COURSE OUTCOMES

On completion of the course, the students will be able to

- CO1 - Apply good programming design methods for program development.
- CO2 - Construct programs that demonstrate effective use of C features including arrays, structures, pointers and files.
- CO3 - Develop Recursive Programs.
- CO4 - Develop programs that perform explicit memory management.
- CO5 - Develop programs in object oriented programming.
- CO6 - Apply generic programming techniques to solve practical engineering problems.

SEEA2401	POWER ELECTRONICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To enhance practical knowledge in power electronic component.
- Ability to handle the hardwired implementation of power electronic components in circuits.
- To examine converter and inverter circuits with various loads.
- To understand the operation of converter and chopper circuits.
- To acquire knowledge about power switches (MOSFET, IGBT).
- To gain knowledge about coupled circuits.

SUGGESTED LIST OF EXPERIMENTS

- 1 SCR Triggering Circuits.
- 2 Single Phase Half & Fully Controlled Bridge Rectifier.
- 3 SCR based series and Parallel Inverter.
- 4 AC Regulator-Phase Control Using DIAC & TRIAC.
- 5 Single phase Cycloconverter.
- 6 MOSFET Based Buck & Boost Converter.
- 7 IGBT Based Single Phase PWM Inverter.
- 8 Voltage Commutated Chopper.
- 9 Current Commutated Chopper.
- 10 Complementary Commutated Chopper.
- 11 Simulation of Single phase and Three phase Controlled Rectifier.
- 12 Simulation of Buck, Boost, Buck-Boost Converter.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply the power conversion process and control of electrical power.

CO2 - Examine the practical implementation of power electronic components in circuits.

CO3 - Analyze the characteristic of the components with load variations.

CO4 - Evaluate the voltage controlled and current controlled components.

CO5 - Design different power electronic topologies.

CO6 - Develop the simulation for different converters.

SECA1502	ANALOG INTEGRATED CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To have thorough understanding of Op-Amp.
- To be able to design circuits using op amp for various applications.
- To acquire knowledge about ADC and DAC.
- To study the basic principles of PLL and Timer Circuit.
- To understand the concept of Special function ICs.

UNIT1 INTRODUCTION TO OP- AMP AND ITS APPLICATIONS.**9Hrs.**

OP-AMP- DC and AC Characteristics- Input offset voltage- Input bias current- Input offset current- Total output offset voltage- Thermal drift- Slew rate- CMRR -Inverting amplifier- Non-inverting amplifier- Voltage follower- Summing and differential amplifier- Integrator- Differentiator- Logarithmic and Anti logarithmic amplifiers-Comparator and Schmitt trigger.

UNIT2 FILTERS AND SIGNAL GENERATORS**9Hrs.**

First order and Second order Butterworth filters- low pass, high pass, band pass and band reject filters -RC phase shift, Wein's bridge oscillator- Astable and Monostable multivibrator-Precision half wave and full wave rectifiers.

UNIT3 A/D AND D/A CONVERTERS**9Hrs.**

Sample and Hold circuit - Digital to analog converters: R-2R ladder network and Binary weighted - Characteristics of D/A converters - Analog to digital converters: Flash converter - Successive approximation converter - Dual slope ADC-Weighted-Capacitor DACs- Oversampling Converters.

UNIT4 PLL AND TIMER CIRCUITS.**9Hrs.**

Phase Locked Loop IC 565- Block schematic - Applications of PLL: FM demodulator and Frequency synthesizers Demodulator- VCO IC LM 566 - Timer IC LM 555 and its applications: Astable and Monostable multivibrator.

UNIT5 SPECIAL FUNCTION ICs**9Hrs.**

Integrated circuit Tuned amplifier, Instrumentation Amplifier, Monolithic voltage regulators 78XX, 79XX Series, Opto coupler, CMOS Operational Amplifier- Dc analysis- small signal analysis- specifications of IC MC 14573.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Design Summer, Subtractor, Multiplier and Divider circuits using op-amp.
- CO2 - Design filter circuits using analog IC's.
- CO3 - Design the op-amp based ADC and DAC converters.
- CO4 - Design suitable op-amp based circuits for the generation of sine, square and triangular waveforms..
- CO5 - Able to use OP Amp to generate sine waveform, Square wave form, Triangular wave forms.
- CO6 - Able to use OP Amp as analog to digital and digital to analog converter.

TEXT / REFERENCE BOOKS

1. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015.
2. D. Roy Choudary, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.
3. Grey and Meyer, "Analysis and Design of Analog Integrated Circuits", 4th Edition, Wiley International, 2001.
4. Michael Jacob, "Applications and Design with Analog Integrated Circuits", 2nd Edition, Prentice Hall of India, 1993.
5. S. Salivahanan, V.S. Kanchana Bhaaskaran, "Linear integrated circuits", 3rd Edition, McGraw-Hill, 2011.
6. William D. Stanely, "Operational Amplifiers with Linear Integrated Circuits", 4th Edition, Pearson Education, 2004.
7. Sergio Franco "Design with Operational Amplifiers and Analog Integrated Circuits" 4th edition, McGraw-Hill Education, 2015.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each – No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SECA1507	DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart basic ideas in discrete signals and systems.
- To gain knowledge of Analog and Digital filter design with various structural realizations.
- To learn DSP controller pertaining to Power Electronics via programming.

UNIT1 INTRODUCTION TO DISCRETE TIME SIGNALS, SYSTEMS AND Z-TRANSFORM 9Hrs.

Sampling theorem, Quantization, Quantization error, Aliasing- mathematical representation of signals, Classifications of Signals and Systems - Review of Z transform & Inverse Z Transform-ROC-Time response analysis using standard test signals (step and ramp) – linear convolution- Correlation.

UNIT2 DISCRETE FOURIER TRANSFORM AND COMPUTATION 9Hrs.

Discrete Time Fourier Transform analysis (DTFT), Discrete Fourier Transform (DFT)- Properties of DFT- frequency response analysis-magnitude and phase response, circular convolution, FFT computations using radix-2 Decimation in Time (DIT) and Decimation in frequency (DIF) algorithms.

UNIT3 DESIGN OF INFINITE IMPULSE RESPONSE FILTER (IIR) 9Hrs.

Design of IIR filters using Impulse invariant and Bilinear transformation method- Prewarping. Review of Butterworth and Chebyshev approximations- Frequency transformation in analog domain- Filter design using Butterworth and Chebyshev- Realization of recursive structures-Direct form-I-Direct form-II-Cascade-Parallel Forms.

UNIT4 DESIGN OF FINITE IMPULSE RESPONSE (FIR) FILTER 9Hrs.

Properties of IIR and FIR filters - Filter design using windowing techniques - Hamming, Hanning, Blackman, Rectangular, Triangular windows- Digital filter design using Frequency sampling technique- Realization of Structures for FIR and Linear phase FIR filter- Direct form-Transposed form- Cascaded form, Elementary Ideas of Finite Word Length effects in Digital Filters.

UNIT5 DSP APPLICATIONS USING TMS320C24X PROCESSOR 9Hrs.

Nomenclature- TMS 320 family overview -Architectural Overview-Central Processing unit – Addressing modes- Event Manager- General purpose timers (GPR)- Full compare Unit (FCU)- Dead band unit- simple programs for PWM generation using GPR and FCU pertaining to Power Electronic applications.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Analyze various signals, systems and transforms.
- CO2 - Apply Discrete-Fourier Transform and Fast Fourier Transform on discrete time signals.
- CO3 - Design IIR digital filters for suitable applications.
- CO4 - Design and analyze FIR digital filters.
- CO5 - Comprehend the architecture of digital signal processing controller (TMS320CX2407).
- CO6 - Develop ALP for motor control application using TMS320CX2407.

TEXT / REFERENCE BOOKS

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", 4th Edition, Pearson education / Prentice Hall, 2007.
2. Emmanuel C. Ifeachor, & Barrie W. Jervis, "Digital Signal Processing", 2nd Edition, Pearson Education / Prentice Hall, 2002.
3. Alan V. Oppenheim, Ronald W. Schaffer & Hohn. R. Back, "Discrete Time Signal Processing", Pearson Education, 2nd Edition, 2005.
4. Andreas Antoniou, "Digital Signal Processing", Tata McGraw Hill, 2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each – No choice**20Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SECA1508	MICROPROCESSOR, INTERFACING AND ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart the knowledge of 8085 and 8086 processor.
- To develop assembly language program in 8085/8086 processor.
- To introduce the peripheral devices.
- To acquire the knowledge of interfacing and hardware implementation.

UNIT1 8085 MICROPROCESSOR**9Hrs.**

8085 Architecture-Timing Diagram-Interrupts-Addressing Modes-Instruction Formats-Instruction Set-Programming of 8085.

UNIT2 8086 MICROPROCESSOR**9Hrs.**

8086 Architecture-Maximum and Minimum Mode-Memory Banks-Memory Segmentation-Programming Model -Instruction Set-Programming of 8086.

UNIT3 PERIPHERALS INTERFACING USING 8085/8086**9Hrs.**

Introduction, memory and I/O interfacing, data transfer schemes, programmable peripheral interface (8255), programmable DMA controller (8257), programmable interrupt controller (8259), Universal synchronous asynchronous receiver transmitter (USART) (8251), programmable counter/interval timer (8254).

UNIT4 INTERFACING CONCEPTS WITH 8085/8086**9Hrs.**

Switches-Matrix Keyboard-interfacing LED, 7 segment LED, LCD, Analog to Digital Converter (ADC), Digital to Analog Converter (DAC), Memory Interfacing (RAM and ROM).

UNIT5 APPLICATIONS USING 8085/8086**9Hrs.**

Stepper motor interfacing with ULN2003-specific angle rotation, Motor speed control, Temperature control system, Traffic light control-6V relay to control AC Bulb-PWM generation for Single phase- controlled rectifier with specific firing angle.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Apply the basics of 8-bit processor to do real time automation programming.
- CO2 - Analyze the 16-bit processors with memory segmentation technique for better programming technique.
- CO3 - Examine the performance enhancement of microprocessor with various peripheral interfacing IC's.
- CO4 - Investigate the operation of various peripheral devices to implement in real time applications.
- CO5 - Design the interfacing circuits for real time applications.
- CO6 - Develop the control circuits for various motor controlled by 8085/8086.

TEXT / REFERENCE BOOKS

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming and applications with 8085", 6th Edition, Penram International Publishing Pvt. Ltd., 2014.
2. Douglas V. Hall, "Microprocessor and its Interfacing", Tata McGraw Hill, Edited second Version, 2006.
3. Nagoor Kani A, "Microprocessor (8085) and its Applications", 2nd Edition, RBA publications, 2013.
4. Mathur A.P, "Introduction to Microprocessor", Tata McGraw Hill, 3rd Edition 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –No choice**20Marks****PART B:** 2 Questions from each unit of internal choice, each carrying 16 marks**80Marks**

SEEA1501	POWER SYSTEM ANALYSIS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart knowledge in modelling of power system elements.
- To implement Numerical methods in power flow problem.
- To analyze the system in various fault conditions.
- To have a knowledge in stability of power systems.

UNIT1 POWERSYSTEMMODELING**9Hrs.**

Need for system analysis in planning and operation of power system - per phase analysis of symmetrical three-phase system. General aspects relating to power flow, short circuit and stability analysis - Modeling of generator, load, shunt capacitor, transmission line, shunt reactor for short circuit, power flow and stability studies -per unit representation - bus admittance by analytical method and direct inspection method.

UNIT2 POWERFLOWANALYSIS**9Hrs.**

Problem definition - bus classification - derivation of power flow equation - solution by Gauss Seidel and Newton Raphson methods by polar form - P V bus adjustments for both methods - computation of slack bus power, line flow and transmission loss.

UNIT 3 SYMMETRICAL SHORTCIRCUITANALYSIS**9Hrs.**

Need for short circuit study - Bus impedance matrix formation - Symmetrical short circuit analysis using Z-bus. - computations of short circuit capacity, post fault voltage and current.

UNIT4 UNSYMMETRICAL SHORTCIRCUITANALYSIS**9Hrs.**

Symmetrical component transformation - sequence impedances.- Sequence Networks - unsymmetrical short circuit analysis for single line fault, line to line fault and double line to ground fault using Z-bus - computations of short circuit capacity, post fault voltage and current.

UNIT5 STABILITY & SECURITY ANALYSIS**9Hrs.**

Distinction between steady state and transient state - Concepts of Stability & Security - Swing equation-solution to swing equation - step by step method - power angle equation - equal area criterion - critical clearing angle and time. Stability analysis of single machine connected to infinite bus by modified Euler's method - Multi-machine stability analysis using Runge Kutta method.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Model Impedance and Reactance networks for the given power system Network and formulate bus admittance matrix.

CO2 - Apply Y Bus in load flow analysis and examine the power flows and voltages in a power grid.

CO3 - Formulate bus impedance matrix and apply Z Bus in symmetrical short circuit analysis and evaluate the fault currents and post fault voltages.

CO4 - Model sequence networks and apply Z Bus in unsymmetrical short circuit analysis and evaluate the fault currents and post fault voltages.

CO5 - Analyze the transient and steady state stability conditions.

CO6 - Solve transient stability problems.

TEXT / REFERENCE BOOKS

1. John J. Grainger and Stevenson Jr. W.D., "Power System Analysis", Tata McGraw Hill, 2017.
2. Kothari .D.P and Nagarath.I.J., "Power system Engineering", 2nd Edition, Tata McGraw Hill, 2011.
3. Pai. M.A., "Computer Techniques in Power System Analysis", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.
4. Nagarath, I.J. and Kothari, D.P., "Modern Power System Analysis", 4th Edition, Tata McGraw Hill Publishing Company, 2011.
5. Hadi Saadat, "Power system Analysis", Tata McGraw Hill Publishing Company, 3rd Edition, 2011.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –No choice**20Marks****PARTB:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SEEA1502	CONTROL SYSTEMS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart knowledge regarding the various types of system and different transfer function analyzing techniques associated with control systems.
- To analyze the response and error of various types of system in time domain.
- To understand the stability analysis of frequency domain systems.
- To analyze the open loop system in frequency domain.
- To implement the design of controllers and compensators.

UNIT1 SYSTEM CONCEPTS**10 Hrs.**

Types of System - Open Loop Systems, Closed Loop Systems, Basic Elements in Control System - Mathematical Models of Physical System: Differential Equation- Transfer Functions of Single Input, Single Output and Multi Variable Systems - Simple Electrical Networks, Electrical Analogous of Mechanical Translational and Rotational System - D.C and A.C Servomotor - Mechanical System- Translational and Rotational System - Block Diagram Reduction Techniques - Signal Flow Graphs - Mason's Gain Formula.

UNIT2 TIME RESPONSE ANALYSIS OF CONTROL SYSTEMS**9Hrs.**

Standard Test Signals - Time Response of First and Second Order System, Time Domain- Specifications - Generalized Error Series - Steady State Error - Static and Dynamic Error Constants.

UNIT3 STABILITY OF CONTROL SYSTEM**9Hrs.**

Characteristics Equation - Location of Roots in S Plane for Stability - Routh Hurwitz Criterion - Root Locus Analysis - Effect of Pole Zero Additions on Root Locus - Nyquist Stability Criterion.

UNIT4 FREQUENCY RESPONSE ANALYSIS**9Hrs.**

Frequency Response of the System - Correlation between Time and Frequency Response - Gain and Phase Margin - Bode Plot - Nyquist Plot (Polar Plot).

UNIT5 COMPENSATION AND CONTROLLERS**8Hrs.**

Introduction to compensation networks - Lag, Lead and Lag Lead networks - Effect of providing Lag, Lead and Lag-Lead compensation on system performance and design using bode plot - P, PI, PID Controllers design.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Determine the transfer function for an electrical and mechanical system.
- CO2 - Analyze the response of any linear time invariant system.
- CO3 - Examine the stability of a system using Routh Hurwitz and root locus criterion.
- CO4 - Analyze the frequency response for linear time invariant system using bode plot and Nyquist plot.
- CO5 - Design a PI, PID controller in existing world problem.
- CO6 - Design lag, lead and lag-lead compensator network for real world problem.

TEXT / REFERENCE BOOKS

1. I.J.Nagarath and M.Gopal, "Control System Engineering" New Age International (p) Limited Publishers, 2nd Edition, 2009.
2. Kausuhio Ogata, "Modern Control Engineering", Prentice Hall of India PVT. Ltd, 5th Edition, 2010.
3. Richard Dorf, "Modern Control Systems", Pearson Education Ltd, 11th Edition 2009.
4. M.N. Bandyopadhyay, "Control Engineering, Theory and Practice" PHI, 4th print, 2006.
5. N.K.Sinha, "Control Systems", New Age International Private Limited Publishers, 3rd Edition, Reprint, 2008.
6. A.Nagoorkani, "Control System", RBA Publications, 3rd Edition, reprint 2012.
7. U.A.Bakshi and S.C.Goyal, "Control System Engineering", Technical Publication, 2nd Revised Reprint 2007.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –No choice**20Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SECA2507	INTEGRATED CIRCUITS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To study the basic principles, configurations and practical limitations of op-amp.
- To understand the various linear and non-linear applications of op-amp.
- To analyze and design op-amp oscillators, single chip oscillators and frequency generators.
- To analyze, design and explain the characteristics and applications of active filters, including the switched capacitor filter.
- To understand the operation of the most commonly used D/A and A/D converter types and its applications.

SUGGESTED LIST OF EXPERIMENTS**ANALOG INTEGRATED CIRCUITS**

1. Design and construct using IC741
 - a). Inverting
 - b). Non-inverting
 - c). Adder
 - d). Schmitt Trigger
 - e). Differentiator
2. Waveform Generators using IC741
 - a). Triangular wave generator
 - b). Square wave generator
 - c). Sine Wave generator
3. Design and construct PWM using IC 555 timer
4. Design a 3 bit DAC in R-2R ladder Configuration
5. Design, construct the filters using PSPICE
 - (a). Low pass filter
 - (b). High pass filter
 - (c). Band pass filter
 - (d). Band reject filter

DIGITAL INTEGRATED CIRCUITS

6. Verify the Basic gates / Boolean function using logic gates.
7. To Construct and verify the full and half adder using logic gates.
8. To Verify 2x4 Decoder and 4x2 Encoder functionally.
9. To construct and study the working of RS flip-flop, D flip-flop, T flip-flop, JK flip-flop
10. To verify various shift register
 - (a). SISO
 - (b). SIPO
 - (c). PISO
 - (d). PIPO
11. Design a counter using suitable flip-flop
 - (a). MOD Counter
 - (b). Ripple Counter
 - (c). Up-Down Counter

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Evaluate the op-amp's basic construction, characteristics, parameter limitations, various configurations and countless applications of op-amp.
- CO2 - Examine operation registers, flipflop counter.
- CO3 - Analyze basic op-amp circuits, particularly various linear and non-linear circuits, active filters, signal generators and data converters.
- CO4 - Examine the basic configuration of IC741, IC555 and various counter operation.
- CO5 - Evaluate the logic gates and combinational circuit using the suitable IC.
- CO6 - Evaluate the various characteristics of the filter circuits using Orcad PSPICE.

SECA2508	MICROPROCESSOR LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To impart the knowledge of 8085 and 8086 processor.
- To develop assembly language program in 8085/8086 processor.
- To introduce the peripheral devices.
- To acquire the knowledge of interfacing and hardware implementation.

SUGGESTED LIST OF EXPERIMENTS

1. Programs for 8 bit Addition, Subtraction, Multiplication and Division.
2. Perform 32 bit Addition of two numbers.
3. Counting numbers of 1's in given word.
4. Arithmetic mean of Square of N Numbers.
5. Code Conversion – BCD to ASCII Conversion, ASCII to BCD Conversion.
6. Finding largest & smallest of given 16 bit Numbers.
7. To Sort given set of Numbers in Ascending & Descending Order.
8. Program using look up table Concept.
9. Matrix Manipulation – 16 bit addition.
10. Perform LCM of two 16 bit numbers, GCD of four 16 bit numbers.
11. Generate Fibonacci Series, Factorial of given Numbers.
12. Interfacing 8086 with Stepper motor. Use Step angle Calculation & rotate motor to a Specified angle.
13. Interface 8086 with DC motor & Control the Speed of the DC Motor using PWM.
14. Interface 8086 With ADC & display the digital input, Perform the resolution calculation and cross verify the result.
15. Interface 8086 With DAC & display the following waveform in CRO. a). Triangular b). Saw tooth c). Staircase.
16. Interface 8086 with 7 segment display to display numbers as Characters.
17. Interface 8086 with LCD to display the name of the person.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the basic arithmetic operations using 8085/8086 microprocessor instruction set.
- CO2 - Familiarize with the Assembly Language programming and concepts of 8085/8086 microprocessors.
- CO3 - Ability to provide solutions to the problems related to advanced data processing.
- CO4 - Design and develop interfacing circuits for stepper motor and DC motor.
- CO5 - Design and develop interfacing circuits for ADC and DAC.
- CO6 - Design and develop interfacing circuits for LCD and Seven segment display.

SEEA1601	ELECTRICAL MACHINE DESIGN	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart knowledge about engineering materials, calculation of mmf for air and iron path for rotating machines.
- To impart knowledge in design of armature and field system of DC machines.
- To impart knowledge in design of core, yoke, windings and cooling systems of transformer.
- To impart knowledge in design of stator and rotor of induction machines.
- To impart knowledge in design of stator and rotor of synchronous machines.

UNIT1 INTRODUCTION**9Hrs.**

Major considerations in Machine design - Limitations in design - Standard specifications - Electrical Engineering materials - High conductivity materials - Insulating materials - Magnetic circuit calculations - mmf for airgap and iron path - real and apparent flux densities in rotating machines - Choice of specific electric and magnetic loadings.

UNIT2 DCMACHINES**9Hrs.**

Output equation - Main Dimensions - Choice of number of poles - Armature design - Estimation of number of conductors / turns - Coils armature slots- Conductor dimensions - Slot dimension - Design of field poles and field coil (shunt field) - Design of Commutators and Brushes.

UNIT3 TRANSFORMERS**9Hrs.**

Output equation - Design of core and winding of single phase shell and core type transformer and three phase transformers - Temperature rise in transformers - Design of tank, cooling tubes and Ducts.

UNIT 4 INDUCTIONMOTORS**9Hrs.**

Output equation, Main dimensions, Design of stator, Choice of L/D ratio - Air gap length - Design of rotor - Squirrel cage and Slip ring rotor.

UNIT5 SYNCHRONOUSMACHINES**9Hrs.**

Output equation - Design of salient pole rotor machine - Dimensions - Short circuit ratio - Effect of Short Circuit ratio - Air gap length-Armature design - Slot dimensions-Rotor design-Design of damper winding -Design of cylindrical rotors.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Analyze the mmf for rotating machines based on the major considerations.

CO2 - Apply the design procedure for DC machines.

CO3 - Analyze the design procedure for core, yoke, winding and cooling systems of transformer.

CO4 - Analyze the design procedure for stator and rotor of induction machines.

CO5 - Analyze the design procedure for stator and rotor of synchronous machines.

CO6 - Design various machine components for specific application.

TEXT / REFERENCE BOOKS

1. A.K.Sawhney, A.Chakrabarti, "A course in Electrical machine Design", Dhanpat Rai and Sons, New Delhi, 6th Edition, 2010.
2. Albert E. Clayton and NN Hancock, "The performance and Design of Direct Current Machines", Oxford and IBH Publishing Co. Pvt.Ltd., New Delhi, Edition 2004.
3. A.Nagoorkani, "Electrical Machine Design", RBA Publications, 2nd Edition, 2014.
4. R.K.Agarwal, "Principles of Electrical Machine Design", 5th Edition, S.K.Kataria & Sons. 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –No choice**20Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SEEA1602	ADVANCED CONTROL SYSTEMS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To gain knowledge in the designing of state space analysis.
- To obtain the state transition matrices and the solution of state equations.
- To design a state observer using the concept of controllability and observability.
- To have a clear understanding in Digital Data Systems.
- To have an exposure in different stability analysis of Nonlinear Systems.

UNIT1 STATESPACEMODEL**9Hrs.**

Introduction to State Space, State Variables, Physical Variables, Phase Variables-Matrices, Eigen Values and Eigen vectors - Diagonalization, Canonical and Jordan forms - State Space Models from Differential Equations - Conversion of State Variable Models to Transfer Function.

UNIT2 MATHEMATICALANALYSIS**9Hrs.**

Computation of State Transition Matrix - Laplace Transformation Method, Canonical Transformation - Cayley Hamilton Theorem-Solution of State Equation.

UNIT3 STATE FEEDBACK AND OBSERVERS**9 Hrs.**

Concepts of Controllability and Observability - Design of State Space Feedback using Pole Placement Technique-State Observers.

UNIT4 SAMPLED DATA SYSTEMS**9Hrs.**

Reconstruction of Sampled Signals using Hold Circuits - Zero Order Hold - its Representation - Bode Plot of Hold Circuit - Z - Transform of Sampled Signals - Theorems on Z- Transform - Inverse Z-transform - Mapping between s and z Planes - Pulse Transfer Function Impulse Response - Closed Loop Operation - Characteristic Equations - Jury's Stability Criterion

UNIT5 NONLINEAR SYSTEMS**9Hrs.**

General Properties of Non-Linear Systems - Describing Function Method - On / Off, Dead Zone, Saturation and Hysteresis Non Linearities - Determination of Limit Cycle by Describing Function - Stability of Limit Cycle - System Stability in the Sense of Lyapunov - Lyapunov's Direct Method - Stability and Instability Theorems - Application of Lyapunov Method for Linear Systems - Basic Concepts of Phase Plane Method.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to
 CO1 - Develop the state model of any linear time invariant system
 CO2 - Obtain the state transition matrices and their solutions.
 CO3 - Analyze controllability and observability for real time systems
 CO4 - Design a state observer using pole placement technique.
 CO5 - Analyze any discrete systems.
 CO6 - Determine the stability of any Nonlinear systems.

TEXT / REFERENCE BOOKS

1. K.Ogata, "Modern control Engineering", 5th Edition. Prentice Hall India, New Delhi.2010.
2. B.C.Kuo, "Automatic Control Systems", Phi learning Pvt Ltd, 9th Edition,2009.
3. Philips C.L., & John Parr "Feedback Control Systems" 5th Edition, Prentice Hall International.2010.
4. Naresh K. Sinha, "Control Systems", New Age International Ltd., Reprint2004.
5. Stanley M.Shinners, "Modern Control System Theory and Design", 3rd Edition, John Wiley & Sons.2004.
6. M.Gopal, "Digital Control and State Variable Methods", 4th Edition, Tata McGraw Hill Ltd., New Delhi,2012.
7. Roy Choudhry, "Modern Control Engineering" Phi Learning,2009.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –No choice**20Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SEEA1603	ELECTRICAL DRIVES AND CONTROL	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge in modeling of powerconverters.
- Understand the dynamics of mechanical system found in industrialapplication.
- Characterize the operation of motor, drive, sensor and mechanical power within thedrive.
- Understand the operation of DC and AC Motordrive.
- Understand the method of starting and braking of electricmotor.
- To have a knowledge of various motor driveapplications.

UNIT1 DRIVESCHARACTERISTICS**8Hrs.**

Electric drives - Advantages - Choice of electric drive, Speed/Torque Characteristics of various types of loads and drive motors, Classes of motor duty- Selection of power rating for drive motors with regard to duty. Thermal model of motor for heating and cooling, Overloading and load variation factors- load equalization.

UNIT2 DCDRIVE**10 Hrs.**

Starting and braking operations of DC motor drive-Speed control of DC motors - Ward Leonard scheme - Drawbacks - Ward Leonard Ilgener scheme - Thyristor converter fed DC Drives: single, two and four quadrant operations. Chopper fed DC Drives: control strategies - single, two and four quadrant operation.

UNIT3 THREE PHASE INDUCTIONMOTORDRIVES**10Hrs.**

Speed control of three phase induction motors: Stator control - Stator voltage, frequency and voltage/frequency control - VSI, CSI and Cycloconverter fed induction motor drives. Rotor control : Rotor resistance control- Static control of rotor resistance using DC Chopper, slip power recovery schemes -Kramer and Scherbius drives.

UNIT4 THREE PHASE SYNCHRONOUSMOTORDRIVES**10 Hrs.**

Speed control of three phase synchronous motors - types of control , Voltage source and current source converter fed synchronous motors -Cycloconverter fed synchronous motors –Commutator less DC motor- Effects of harmonics on the performance of AC motors -Closed loop control of drive motors, Marginal angle control and power factor control.

UNIT5 DRIVEAPPLICATIONS**7Hrs.**

Selection of drives and control schemes for steel rolling mills, Paper mills, textile mills and cranes - Traction- conventional DCandACTractiondrives-DC TractionusingChopperControlled Drives-PolyphaseACmotorsfor TractionMotors.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Select suitable drives for a specific application.
- CO2 - Analyze the construction, characteristics and application of D.C. motor.
- CO3 - Design the converter for AC and DCdrives.
- CO4 - Analyze the performance of speed control of three phase synchronous motor drive.
- CO5 - Design solutions by using drives in traction unit in railways.
- CO6 - Design torque, speed and position controller of motor drives Control schemes for steel rolling mills, Paper mills, lifts and crane.

TEXT / REFERENCE BOOKS

- Gopal K. Dubey, "Fundamentals of Electrical Drives", Alpha Science International Ltd, 2002.
- Vedam. Subrahmanyam "Electric Drives" Mc graw hill, 2nd Edition 2011.
- Rashid M.H., "Power Electronics circuits Devices and Applications", Prentice Hall, 3rd Edition, New Delhi, 2009.
- JuhaPyrrhonen, ValeriaHrabovcova&R.ScottSemken, "ElectricalMachineDrivesControl: AnIntroduction", 2016.
- B.K. Bose, "Power Electronic & AC drives", Prentice Hall, 2006.
- Control of Electrical Drives by Ws. Leonhard (Springer 2001).

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3Hrs.****PART A:** 10 Question of 2 marks each –No choice**20Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80Marks**

SEEA2601	MEASUREMENTS AND CONTROLS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To impart knowledge on analysis and design of control system along with basics of instrumentation.
- To implement the measurement techniques for various electrical quantities.
- To analyze the transfer function of DC machines.
- To design compensators for an appropriate applications.
- To synthesis speed of multiple machines by applied voltage control method.

SUGGESTED LIST OF EXPERIMENTS

- 1 Measurement of self-inductance by Maxwell's inductance bridge.
- 2 Calibration of Ammeter, Voltmeter and Wattmeter.
- 3 Calibration of Three phase energymeter.
- 4 Instrumentation Amplifier.
- 5 Study of LVDT and Pressure Transducer.
- 6 Design of P, PI and PID controller.
- 7 Study of temperature measuring transducers (Thermocouple).
- 8 Transfer function of DC generator.
- 9 Transfer function of Field controlled DC motor.
- 10 Transfer function of Armature controlled DC motor.
- 11 Speed Control of Ward Leonard system.
- 12 Transfer function of lag, lead and lag-lead network.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply optimal control and non-linear control techniques.

CO2 - Analyze design and operation of control systems employed in various industries.

CO3 - Analyze the transfer function of various DC Machines.

CO4 - Describe P, PI, PID controller for any applications using MATLAB.

CO5 - Examine the physical parameters by using various transducers.

CO6 - Evaluate the basic meters and energy meter by calibrating the error.

SEEA2602	POWER SYSTEMS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To have hands on experience on various system studies and different techniques used for system planning using Softwarepackages.
- To gain Knowledge in designing of automationproblem.

SUGGESTED LIST OF EXPERIMENTS

1. Computation of Power System Components in Per Unit.
2. Formulation of the bus admittance matrix by Direct inspectionmethod.
3. Formulation of the bus admittance matrix by Singular transformationmethod.
4. Formation of bus impedancematrix.
5. Analysis of Daily LoadCurve.
6. Automatic Generation Control.
7. Determination of Transmission lineparameters.
8. Numerical Integration of Swingequation.
9. Load flow solution using Gauss – Seidal method.
10. Load flow solution using Newton – Rapson method.
11. Faultanalysis.
12. Characteristics of Microcontroller based Frequencyrelay.
13. Construction of simple ladder program for Logicgates.
14. Applications of Delay Timers inPLC.
15. Applications of Counters inPLC.

COURSE OUTCOMES:

On completion of the course, student will be able to

- CO1 - Create bus impedance and admittance matrix and compute P.U power system model.
- CO2 - Estimate the various fault currents in power system and compute inductance in Transmission lines.
- CO3 - Solve the power flow analysis using Gauss Seidel and N-R method.
- CO4 - Analyze the daily load curve and automatic generation control.
- CO5 - Identify the stability of system and characteristics of various relay.
- CO6 - Design ladder diagram for different automation problem usingPLC.

SAIC4003	UNIVERSAL HUMAN VALUES	L	T	P	Credits	Total Marks
		2	1	0	3	100

COURSE OBJECTIVES

- To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- To understand (or developing clarity) the harmony in the human being, family, society and nature/existence.
- To strengthen self-reflection.
- To develop commitment and courage to act.

MODULE 1: 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 fulfil the above human aspirations: understanding and living in harmony at various levels.
- 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.

MODULE 2: UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
 8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
 10. Understanding the characteristics and activities of 'I' and harmony in 'I'
 11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
 12. Programs to ensure Sanyam and Health.
- 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.

MODULE 3: UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
 14. Understanding the meaning of Trust; Difference between intention and competence
 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
 16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
 17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
- 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.

MODULE 4: UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

18. Understanding the harmony in the Nature
 19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
 20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
 21. Holistic perception of harmony at all levels of existence.
- 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.

MODULE 5: IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. 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.
26. Case studies of typical holistic technologies, management models and production systems
27. 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
28. Sum up.

Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

TOTAL: 28 LECTURES AND 14 PRACTICE SESSIONS

COURSE OUTCOMES

By the end of the course, students are expected.

- CO1: To become more aware of themselves, and their surroundings (family, society, nature)
CO2: They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind
CO3: They would have better critical ability
CO4: They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)
CO5: It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

TEXT/ REFERENCE BOOKS

1. R Gaur, R Sangal, G P Bagaria, " Human Values and Professional Ethics", Excel Books, New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews
8. J C Kumarappa Economy of Permanence -
9. Bharat Mein Angreji Raj - PanditSunderlal
10. Dharampal Rediscovering India
11. Mohandas K. Gandhi Hind Swaraj or Indian Home Rule
12. Maulana Abdul Kalam Azad, India Wins Freedom
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

ASSESSMENT:

Assessment by faculty mentor	: 10 marks
Self-assessment	: 10 marks
Assessment by peers	: 10 marks
Socially relevant project/Group Activities/Assignments	: 20 marks
Semester End Examination	: 50 marks

**B.E. – ELECTRICAL AND ELECTRONICS ENGINEERING
REGULATIONS 2015 – CURRICULUM**

SEMESTER I

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SHS1101	English for Science and Technology	3	0	0	3	1
	SCH1101	Environmental Science and Engineering	3	0	0	3	14
2	SMT1101	Engineering Mathematics – I	3	1	0	4	3
3	SPH1101	Physics of Engineering Materials	3	0	0	3	3
4	SCY1101	Engineering Chemistry	3	0	0	3	5
5	SCS1102	Fundamentals of Programming	3	0	0	3	6
6	SEE1101	Electricity and Magnetism	3	0	0	3	7
PRACTICAL							
1	SPH4051	Engineering Physics Lab	0	0	2	1	8
2	SCY4051	Engineering Chemistry Lab	0	0	2	1	9
3	SCS4101	Programming in C Lab	0	0	4	2	10
TOTAL CREDITS						23	

SEMESTER II

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SMT1105	Engineering Mathematics – II	3	1	0	4	11
2	SPH1102	Physics for Electronic Devices	3	0	0	3	12
3	SCY1102	Chemistry of Electronic Materials	3	0	0	3	13
4	SHS1101	English for Science and Technology	3	0	0	3	1
	SCH1101	Environmental Science and Engineering	3	0	0	3	14
5	SEC1101	Electronic Devices	3	0	0	3	16
6	SEE1106	Circuit Theory and Network Analysis	3	1	0	4	17
PRACTICAL							
1	SME4053	Engineering Graphics	1	0	2	2	18
2	SEE4052	Electrical circuits and Electronic Devices lab	0	0	4	2	19
TOTAL CREDITS						24	

L – Lecture hours; T – Tutorial hours; P – Practical hours; C - Credits

SEMESTER III

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SMT1201	Engineering Mathematics - III	3	1	0	4	20
2	SME1210	Solid and Fluid Mechanics	3	0	0	3	21
3	SEC1203	Electronic Circuits	3	0	0	3	22
4	SEC1207	Digital Logic Circuits	3	0	0	3	23
5	SEE1202	Electromagnetic Theory	3	0	0	3	24
6	SEE1204	DC Machines & Transformers	3	0	0	3	25
PRACTICAL							
1	SEC4052	Electronic Circuits Lab	0	0	4	2	26
2	SEE4053	DC Machines and Transformers lab	0	0	4	2	27
TOTAL CREDITS						23	

SEMESTER IV

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SMT1204	Engineering Mathematics – IV	3	1	0	4	28
2	SCS1202	Object Oriented Programming	3	0	0	3	29
3	SME1208	Applied Thermal Engineering	3	0	0	3	30
4	SEE1203	Control Systems	3	1	0	4	31
5	SEE1206	Transmission and Distribution	3	1	0	4	32
6	SEE1205	AC Machines	3	0	0	3	33
PRACTICAL							
1	SCS4201	Object Oriented Programming lab	0	0	4	2	34
2	SEE4054	AC Machines Lab	0	0	4	2	35
3	S14PT1	Professional Training – 1	0	0	0	5	
TOTAL CREDITS						29	

SEMESTER V							
Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SEC1302	Analog Integrated Circuits	3	0	0	3	36
2	SIC1203	Measurements and Instrumentation	3	0	0	3	37
3	SEC1310	Microprocessor Interfacing and its Applications	3	0	0	3	38
4	SEE1301	Advanced Control Systems	3	1	0	4	39
5	SEE1302	Power System Analysis	3	1	0	4	40
6	SEE1304	Electrical Machine Design	3	1	0	4	41
PRACTICAL							
1	SEC4054	Integrated Circuits Lab	0	0	4	2	42
2	SEC4068	Microprocessor Lab	0	0	4	2	43
TOTAL CREDITS						25	

SEMESTER VI							
Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SEC1315	Digital Signal Processing & its Applications	3	0	0	3	44
2	SEE1305	Power Electronics	3	0	0	3	45
3	SEE1306	Electric Drives and Control	3	0	0	3	46
4	SEE1307	Special Electrical Machines	3	0	0	3	47
5	SEE1303	Power Generation and Utilization	3	0	0	3	48
6		Elective – I	3	0	0	3	
PRACTICAL							
1	SEE4055	Measurements and Controls Lab	0	0	4	2	49
2	SEE4056	Power Systems Lab	0	0	4	2	50
3	S14PT2	Professional Training – 2	0	0	0	5	
TOTAL CREDITS						27	

SEMESTER VII

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SEC1317	Principles of Embedded System	3	0	0	3	51
2	SEE1401	Power System Protection and Switchgear	3	0	0	3	52
3		Elective – 2	3	0	0	3	
4		Elective – 3	3	0	0	3	
PRACTICAL							
1	SEC4071	Embedded System Design Lab	0	0	4	2	53
2	SEE4057	Power Electronics Lab	0	0	4	2	54
3		Project Work – Phase 1					
TOTAL CREDITS						16	

SEMESTER VIII

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
THEORY							
1	SBA1101	Principles of Management and Professional Ethics	3	0	0	3	55
2	SEE1402	High Voltage Engineering	3	0	0	3	56
3		Elective – 4	3	0	0	3	
4		Project Work (Phase 1 & 2)	0	0	30	15	
TOTAL CREDITS						: 24	
TOTAL CREDITS FOR THE COURSE						: 191	

ELECTIVE COURSES

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
1	SEC1304	Fundamentals of Communication Engineering	3	0	0	3	57
2	SEC1316	CMOS VLSI Design	3	0	0	3	58
3	SEC1402	Programming in HDL	3	0	0	3	59
4	SEC1602	ASIC Design	3	0	0	3	60
5	SEE1601	Flexible AC Transmission System	3	0	0	3	61
6	SEE1602	Power System Dynamics	3	0	0	3	62
7	SEE1603	Power System Operation and Control	3	0	0	3	63
8	SEE1604	EHV AC and DC Transmission	3	0	0	3	64
9	SEE1605	Power System Restructuring and Deregulation	3	0	0	3	65
10	SEE1606	Static Relays	3	0	0	3	66
11	SEE1607	Renewable Energy Systems	3	0	0	3	67
12	SEE1608	Computer Aided Design	3	0	0	3	68
13	SEE1609	Computer Aided Design of Electrical Equipment	3	0	0	3	69
14	SEC1606	Digital Image Processing	3	0	0	3	70
15	SEC1609	Fundamentals of Fuzzy Logic and Artificial Neural Networks	3	0	0	3	71
16	SEC1617	Advanced Electronic Test Engineering	3	0	0	3	72
17	SEC1618	Programming in MATLAB	3	0	0	3	73
18	SIC1310	Theory of Robotics	3	0	0	3	74
19	SIC1311	Biomedical Instrumentation	3	0	0	3	75
20	SIC1605	Fiber Optics and Laser Instrumentation	3	0	0	3	76
21	SIC1608	Power Plant Instrumentation	3	0	0	3	77
22	SIC1611	Fundamentals of Mechatronics	3	0	0	3	78
23	SPR1307	Resource Management Techniques	3	0	0	3	79
24	SEE1610	Advanced Power Electronics	3	0	0	3	80
25	SEE1611	Electric Vehicle	3	0	0	3	81
26	SEE1612	Electrical Power Quality	3	0	0	3	82
27	SEE1613	Energy Storage Systems	3	0	0	3	83
28	SEE1614	Industrial Instrumentation And Automation	3	0	0	3	84
29	SEE1615	Testing And Commissioning of Electrical Equipment	3	0	0	3	85
30	SEE1616	Embedded Systems and IoT	3	0	0	3	86

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	C	Page No.
31	SEE1617	Computer Aided Electrical Drawing	3	0	0	3	87
32	SEE1618	Industrial Drives And Automation	3	0	0	3	88
33	SEE1619	Computer Control of Electric Drives	3	0	0	3	89
34	SEE1620	Modern Power Converters	3	0	0	3	90
35	SEE1621	Distributed Generation and Microgrid	3	0	0	3	91
36	SEE1622	FACTS and HVDC	3	0	0	3	92
37	SEE1623	Energy Management And SCADA	3	0	0	3	93
38	SEE1624	High Voltage Engineering And HVDC Transmission	3	0	0	3	94
39	SEE1625	EHVAC Transmission	3	0	0	3	94
40	SEE1626	Smart Grid	3	0	0	3	96
41	SEE1627	Green Energy Systems	3	0	0	3	97
42	SEE1628	Electric Vehicles	3	0	0	3	98

SEC1207	DIGITAL LOGIC CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To publicize the student with the design and analysis of Boolean algebra, logic gates, combinational circuits, sequential circuits, digital logic families and programmable logic devices. On completion of this course the student will recognize
- Various number systems and to simplify the mathematical expressions using Boolean functions- simple problems.
- Implementation of combinational circuits and Design of various synchronous and asynchronous circuits.
- Expose to various digital logic families and the students to various memory devices and programmable logic devices

UNIT 1 BOOLEAN ALGEBRA AND LOGIC GATES

9 Hrs.

Review of number systems - Binary arithmetic - Binary codes - Boolean algebra and theorems - Boolean functions - Minimization of Boolean functions-Sum of Products (SOP)-Product of Sums (POS)-Simplifications of Boolean functions using Karnaugh map and tabulation methods - Logic gates- NAND and NOR implementation.

UNIT 2 DESIGN OF COMBINATIONAL CIRCUITS

9 Hrs.

Introduction to Combinational circuits - Analysis and design procedures - Half Adder, Full Adder-Half Subtractor, Full Subtractor- Parallel binary Adder, Parallel binary Subtractor- Carry look ahead Adder- BCD Adder-Decoders- Encoders- Priority Encoder- Multiplexers- MUX as universal combinational modules- Demultiplexers-Code converters- Magnitude Comparator.

UNIT 3 DESIGN OF SEQUENTIAL CIRCUITS

9 Hrs.

Introduction to Sequential circuits - Flip flops - SR, JK, D and T flip flops, Master Characteristic and excitation table - Realization of one flip flop with other flip flops - Registers - Counters - Synchronous and Asynchronous counters - Modulus counters, Up/Down counters Johnson Counter - State diagram, State table, State minimization - Hazards.

UNIT 4 DIGITAL LOGIC FAMILIES

9 Hrs.

Classification and characteristics of logic family - Bipolar logic family - Saturated logic family - RTL, DTL,DCTL, I 2L,TTL, HTL - Non saturated family - Schottky TTL, ECL - Unipolar family - MOS, CMOS logic families. Tristate logic. Interfacing of CMOS and TTL families. Comparison of logic families.

UNIT 5 MEMORIES AND PROGRAMMABLE LOGIC DEVICES

9 Hrs.

Classification of memories - ROM - ROM organization - PROM - EPROM - EEPROM - RAM - RAM organization - Write operation - Read operation - Memory decoding - Memory expansion - Static RAM - Dynamic RAM - Programmable Logic Devices - Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Comprehend the Number systems, binary codes, binary arithmetic, Boolean algebra and Logic gates
- CO2 - Apply the concepts of Combinational circuits for their implementation
- CO3 - Design the various types of sequential logic circuits
- CO4 - Analyze the different types of Digital Logic families
- CO5 - Investigate the behavior and characteristics of digital logic families, PLDs
- CO6 - Create the structures of SRAM and DRAM

TEXT / REFERENCE BOOKS

1. Milos Ercegovic, Jomas Lang, "Introduction to Digital Systems", Wiley publications, 1998.
2. John M. Yarbrough, "Digital logic: Applications and Design", Thomas - Vikas Publishing House, 2002.
3. R.P.Jain, "Modern digital Electronics", 3rd Edition, TMH, 2003.
4. William H. Gothmann, "Digital Electronics", Prentice Hall, 2001.
5. Morris Mano, "Digital design", 3rd Edition, Prentice Hall of India, 2008

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1202	ELECTROMAGNETIC THEORY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

To impart knowledge on the concepts of Electro-magnetic field which is essential for understanding the working principle, design and analysis of Electrical machines and Systems.

UNIT 1 ELECTRIC FIELDS

9 Hrs.

Introduction - Concepts of Different Co-Ordinate Systems - Coulomb's Law, Electric Field Intensity, Electric Field due to Point Charge, Line Charge, Surface Charge and Volume Charge Distributions - Electric Flux Density - Gauss Law - Application of Gauss Law - Electric Potential - Potential Gradient - Divergence and Divergence Theorem - Poisson's and Laplace equation.

UNIT 2 CONDUCTORS AND DIELECTRICS

9 Hrs.

Field due to Dipoles - Dipole Moment - Boundary Conditions at Dielectric and Conductor Surfaces - Capacitor and Capacitance of a System of Conductors - Energy Stored and Energy Density - Capacitance due to Spherical Shell, Coaxial cable and Two Wire Transmission Line - Electrostatic Potential Energy Associated with Different Charges.

UNIT 3 MAGNETIC FIELDS

9 Hrs.

Current and Current Density - Conduction and Convection Current - Force on a Current Element - Biot- Savart's law - Force between Current Carrying Conductors - Torque on Closed Conductors - Ampere's Law- Magnetic Flux Density - Curl and Stokes Theorem - Magnetic Vector Potential - Boundary Condition at the Magnetic surfaces.

UNIT 4 FARADAY'S LAWS OF ELECTROMAGNETIC INDUCTION

9 Hrs.

Faradays' Laws - Self and Mutual Inductance - Inductance of Solenoids, Toroids, Transmission Lines and Cables - Energy Stored and Density in Magnetic Circuits.

UNIT 5 MAXWELL'S EQUATION AND ELECTROMAGNETIC WAVES

9 Hrs.

Concept of Displacement and Conduction Current - Modified Ampere's Circuital Law - Maxwell's Equations in point and Integral Forms - Wave Equations - Plane Waves in Free Space - Polarization - Poynting's Theorem and Poynting Vector and its Significance - Energy in Electromagnetic Field.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Comprehend the various laws used in electromagnetic fields.
- CO2 - Comprehend the concepts of capacitance in cables and transmission lines.
- CO3 - Apply the concepts of basic theorems and laws relating to magnetic field.
- CO4 - Analyze self and mutual inductance in solenoid, toroid, transmission lines and cables.
- CO5 - Evaluate the interaction of electric and magnetic fields in various media.
- CO6 - Design electrical system using Maxwell's equation.

TEXT / REFERENCE BOOKS

1. K.A. Gangadhar, "Electromagnetic Field Theory (Including Antenna Wave Propagation)", Khanna Publisher New Delhi, 2009.
2. Karl.E.Lonngren, Sava.V.Savov, "Fundamentals of Electromagnetics with MATLAB", PHI, 2005.
3. William Hayt, "Engineering Electromagnetics", Tata McGraw - Hill, New York, 7th Edition, 2006,
4. R.Meenakumari & R.Subasri, "Electromagnetic Fields", New Age International Publishers, 2nd Edition, 2007.
5. E.C.Jordan & K.G.Balmain, "Electromagnetic Waves & Radiating Systems", Prentice- Hall, 2006.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1204	DC MACHINES AND TRANSFORMERS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To study the fundamental principles of Electrical machines using the concepts of electro-mechanical energy conversion.
- To acquaint the constructional details, the principle of operation and prediction of performance characteristics of D.C Machines and Transformers.
- To study about the various losses and different testing methods to determine the performance of D.C Machines and Transformers.

UNIT 1 ELECTRO-MECHANICAL CONVERSION

9 Hrs.

Introduction - Principles of Energy Conversion - Field Energy and Co-energy in Linear Systems - Energy Flow - Losses and Efficiency - Singly and Multiply Excited Magnetic Field Systems - Torque Production in Rotating Machines - General Analysis of Electromechanical system

UNIT 2 D.C. GENERATORS

9 Hrs.

Constructional Details - Principle of Operation - E.M.F Equation - Methods of Excitation - Types - No load & Load characteristics of Series, Shunt & Compound generators - Armature Reaction, Effects, Methods of Compensation - Commutation: Methods of Improving Commutation - Applications.

UNIT 3 D.C. MOTORS AND TESTING OF D.C. MACHINES

9 Hrs.

Principle of Operation - Back E.M.F & Torque Equation - Characteristics of Series, Shunt & Compound Motors - Starters - Speed Control of DC Series & Shunt Motors - Electrical Braking - Testing of DC Machines - Brake Test, Swinburne's Test & Hopkinson's Test.

UNIT 4 TRANSFORMERS

9 Hrs.

Principle of Operation - Constructional Details - E.M.F. Equation - Transformation Ratio - Transformer on No Load - Parameters Referred to HV / LV Windings - Equivalent Circuit - Transformer On Load - Phasor diagram - Regulation - Testing of Transformer - Open Circuit and Short Circuit Test - All day Efficiency - Sumpner's Test.

UNIT 5 SPECIAL TRANSFORMERS AND THEIR APPLICATIONS

9 Hrs.

Auto Transformer - Saving of copper in comparison with Two winding Transformer - Parallel Operation of Single Phase Transformers - Construction of Three Phase Transformer - Transformer Connections – Scott connection - Three Phase to Single Phase Transformer conversion - Elementary Ideas on Instrument Transformers and Toroidal Transformer.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply the energy conversion concept to electrical machines.
- CO2 - Examine the performance of DC generator.
- CO3 - Determine the winding resistance required to control the speed of DC motor.
- CO4 - Evaluate the performance of a single phase transformer..
- CO5 - Evaluate the amount of copper saved in auto transformer
- CO6 - Justify the transformer connection for various applications.

TEXT / REFERENCE BOOKS

1. A K Theraja & B L Thereja, "A Text book of Electrical Technology (Vol II)", S Chand & Co- 23 rd Edition 2008.
2. I J Nagrath and D P Kothari , "Electrical Machines", Tata McGraw Hill Publishing Company Limited New Delhi, 3rd Edition, 2007.
3. R.K.Rajput, "Electrical Machine", Laxmi Publications, 5th Edition 2008.
4. J.B. Gupta, "Theory and Performance of Electrical Machines", S.K.Kataria and Sons, Reprint 2010.
5. S K Sen, "Electrical Machinery", Khanna Publishers, New Delhi, Reprint 2002.
6. Theodore Wildi, Electrical Machines, Drives and Power Systems, Pearson, 6th Ed, 2007.
7. Irving Kosow, Electric Machinery and Transformers, Pearson, 2nd Ed, 2007.
8. Albert E. Clayton and NN Hancock, "The performance and Design of Direct Current Machines", Oxford and IBH.Publishing Co. Pvt.Ltd., New Delhi, 1990.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEC4052	ELECTRONIC CIRCUITS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Determination of Ripple factor, % Regulation of HWR with and without filter.
2. Determination of Ripple factor, % Regulation of FWR with and without filter.
3. Design of series voltage regulator and perform line and load regulation.
4. Design of various Biasing techniques for CE amplifier.
5. Design and construct BJT Common Emitter Amplifier using voltage divider bias (self-bias) with and without bypassed emitter resistor.
6. Darlington Amplifier using BJT.
7. Differential amplifier using BJT
8. Design of RC Phase shift oscillator for a specified frequency.

Simulation Using PSPICE

1. Frequency response of BJT Common Emitter Amplifier
2. Frequency response of BJT Common Base Amplifier
3. Frequency response of JFET Common Source Amplifier
4. Time response of Astable Multivibrator, Mono stable Multivibrator and Bistable Multivibrator
5. Frequency response of Class A Power Amplifier
6. Frequency response of Series and Shunt Feedback amplifier
7. Time response of Hartley, Colpitts Oscillator
8. Time and frequency response of Single Tuned Amplifier

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the principle of rectifier and regulator and observe its performance.
- CO2 - Analyze the characteristics of transistor using different biasing techniques and verify using PSPICE
- CO3 - Examine the performance of Darlington and differential Amplifiers.
- CO4 - Obtain time response characteristics of multi vibrators and single tuned amplifiers.
- CO5 - Simulate frequency response characteristics of feedback and power amplifier circuits using PSPICE.
- CO6 - Design and develop Hartley, Colpitts and RC Phase Shift oscillator circuits and verify using PSPICE.

SEE4053	DC MACHINES AND TRANSFORMERS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. OCC and load characteristics of self excited dc shunt generator
2. OCC and load characteristics of separately excited dc shunt generator
3. Load characteristics of DC series generator
4. Load characteristics of DC compound generator (Differential and Cumulative)
5. Load characteristics of DC shunt motor
6. Load characteristics of DC series motor
7. Load characteristics of DC compound motor (Differential and Cumulative)
8. Speed control of DC shunt motor
9. Swinburne's test on DC shunt motor
10. Hopkinson's test.
11. OC and SC test on single phase transformer
12. Load test on single phase transformer
13. Parallel Operation of Single Phase Transformer
14. Sumpner's Test on Single Phase Transformer

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyze the no load and load characteristics of DC Generators
- CO2 - Examine the electrical and mechanical characteristics of various motors.
- CO3 - Evaluate the performance characteristics on constant flux machine and adapt various speed control techniques on DC shunt motor.
- CO4 - Determine the performance characteristics of a DC machine when operating as motor and as generator.
- CO5 - Investigate the performance, regulation and losses on single phase transformer.
- CO6 - Investigate performance indices of transformer using standard analytical as well as graphical methods.

SCS1202	OBJECT ORIENTED PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the fundamental concepts of object oriented programming.
- Be familiar with concepts like abstraction, inheritance, polymorphism.
- To understand the concept of Classes.

UNIT 1 INTRODUCTION TO OBJECT ORIENTED PROGRAMMING

9 Hrs.

Object Oriented Programming Paradigms - Comparison of Programming Paradigms - Basic ObjectOriented Programming concepts - Comparison with C - Overview of C++ - Pointers - Functions - Scope and Namespaces - Source files and programs.

UNIT 2 CLASSES AND OBJECTS

9 Hrs.

Working with classes - Classes and objects - Class specification - Defining class members – Objects Accessing member functions - Inline Functions - Data hiding - Class member accessibility - Empty classes.

UNIT 3 CONSTRUCTORS AND OVERLOADING

9 Hrs.

Default constructors - Parameterized constructors - Constructor overloading - Copy constructors - new, delete operators- "this" pointer - friend classes and friend functions - Function overloading- Unary Operator overloading - Binary Operator overloading.

UNIT 4 INHERITANCE

9 Hrs.

Base class and derived class relationship - Derived class declaration - Forms of inheritance - Inheritance and member accessibility - Constructors in derived class - Destructors in derived class - Multiple inheritance - Multi level inheritance - Hybrid inheritance - Virtual base classes - Member function overriding - Virtual functions – Abstract classes - Pure Virtual functions.

UNIT 5 I/O AND LIBRARY ORGANIZATION

9 Hrs.

I/O Stream - File I/O - Exception Handling - Templates - STL - Library Organization and Containers – Standard Containers - Overview of Standard Algorithms - Iterators and Allocators.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Comprehend the concept of Procedure Oriented and Object Oriented Programming.
- CO2 - Apply data hiding and inline functions in object oriented programming..
- CO3 - Analyze the concept of constructors, overloading and friend functions
- CO4 - Develop programs for code reusability using inheritance, virtual functions and Abstract class
- CO5 - Create an application using C++ for implementing Exception Handling and Files.
- CO6 - Develop programs using advanced features of C++ specifically templates STL, iterators and allocators for real world problems.

TEXT / REFERENCE BOOKS

1. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill,4th Edition,2010.
2. Venu Gopal K.R, Ravishankar.T, and Raj kumar, "Mastering C++", Tata McGraw Hill,1999.
3. Bjarne Stroustrup, "The C++ programming language", Addison Wesley, 3rd Edition,1998.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1203	CONTROL SYSTEMS	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 SYSTEM CONCEPTS

14 Hrs.

Types of System - Open Loop Systems, Closed Loop Systems, Basic Elements in Control System - Mathematical Models of Physical System: Differential Equation- Transfer Functions of Single Input, Single Output and Multi Variable Systems - Simple Electrical Networks, Electrical Analogous of Mechanical Translational and Rotational System - D.C and A.C Servomotor - Mechanical System- Translational and Rotational System - Block Diagram Reduction Techniques - Signal Flow Graphs - Mason's Gain Formula.

UNIT 2 TIME RESPONSE ANALYSIS OF CONTROL SYSTEMS

10 Hrs.

Standard Test Signals -Time Response of First and Second Order System, Time Domain- Specifications - Generalized Error Series - Steady State Error - Static and Dynamic Error Constants.

UNIT 3 STABILITY OF CONTROL SYSTEM

12 Hrs.

Characteristics Equation - Location of Roots in S Plane for Stability - Routh Hurwitz Criterion - Root Locus Analysis - Effect of Pole Zero Additions on Root Locus - Nyquist Stability Criterion.

UNIT 4 FREQUENCY RESPONSE ANALYSIS

12 Hrs.

Frequency Response of the System - Correlation between Time and Frequency Response - Gain and Phase Margin - Bode Plot - Nyquist Plot (Polar Plot).

UNIT 5 COMPENSATION AND CONTROLLERS

12 Hrs.

Introduction to compensation networks - Lag, Lead and Lag Lead networks - Effect of providing Lag, Lead and Lag-Lead compensation on system performance and design using bode plot - P, PI, PID Controllers design.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Determine the transfer function for a electromechanical system
- CO2 - Analyze the response of any linear time invariant system
- CO3 - Examine the stability of a system using root locus, Routh Hurwitz criterion .
- CO4 - Analyze the frequency response for linear time invariant system using bode plot
- CO5 - Design a P,PI,PID controller in real world problem.
- CO6 - Design a Lag, Lead, Lag-Lead compensator network for real world problem

TEXT / REFERENCE BOOKS

1. I.J.Nagarath and M.Gopal, "Control System Engineering" New Age International (p) Limited Publishers, 2nd edition, 2009.
2. Kausuhio Ogata, "Modern Control Engineering", Prentice Hall of India PVT. Ltd, 5th edition.
3. Richard Dorf, "Modern Control Systems", Pearson Education Ltd, 11th Edition 2009.
4. M.N. Bandyopadhyay, "Control Engineering, Theory and Practice" PHI, 4th print, 2006.
5. N.K.Sinha, "Control Systems", New Age International Private Limited Publishers, 3rd Edition, 1998, reprint 2004.
6. A.Nagoorkani, "Control System", RBA Publications, 3rd edition, reprint 2012.
7. U.A.Bakshi and S.C.Goyal, "Control System Engineering", Technical Publication, 2nd Revised reprint 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1206	TRANSMISSION AND DISTRIBUTION	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 STRUCTURE OF ELECTRIC POWER SYSTEM

12 Hrs.

Single Line Diagram - Distributors with Concentrated and Uniform Loading - DC Two Wire and Three Wire Systems - AC Distributors - Radial and Ring Distributors - Interconnectors - Electrical Layout & Bus Bar Arrangement in Generating Sub Stations and Bulk Power Substation - Kelvin's Law for the Design of Feeders and its Limitations.

UNIT 2 TRANSMISSION LINE PARAMETERS

12 Hrs.

Resistance, Inductance and Capacitance of Single Phase and Three Phase (Including Double Circuits) Transmission Lines - Stranded and Bundled Conductors - Symmetrical and Unsymmetrical Spacing - Transposition - Application of Self and Mutual GMD - Skin and Proximity Effect - Inductive Interference with Neighboring Circuits - Corona - Factors Affecting Corona - Advantages and Disadvantages of Corona - Methods of Reducing Corona Effect.

UNIT 3 PERFORMANCE OF TRANSMISSION LINES

12 Hrs.

Equivalent Circuits for Short, Medium (π and T circuits) and Long Lines - Efficiency and Regulation - Attenuation Constant, Phase Constant, Surge Impedance and Surge Impedance Loading - Real and Reactive Power Flows in Lines - Power Circle Diagrams for Receiving and Sending Ends - Voltage Control of Lines - Ferranti Effect

UNIT 4 INSULATORS, CABLES AND OVERHEAD LINES

12 Hrs.

Insulators - Types and Construction - Voltage Distribution in String Insulator - string Efficiency - Methods of Improving String Efficiency - Cables - types - Capacitance of Cables - Insulation Resistance - Dielectric Stress and Grading - Dielectric Loss - Thermal Characteristics - capacitance of Three Core Cables - Stress and Sag Calculations - Effect of Wind and Ice - Supports at Different Levels - stringing Chart.

UNIT 5 RECENT TRENDS IN TRANSMISSION

12 Hrs.

Extra High Voltage AC (EHVAC) Transmission - Need, Advantages, Limitations -High Voltage Direct current Transmission (HVDC) - Terminal Equipment for HVDC Systems - Classifications, Advantages, Limitations - Economic Distance for HVDC - Comparison of EHVAC and HVDC Transmission -Interconnection of HVDC & AC Systems - Introduction to FACTS Technology -SVC, TCSC, STATCOM, UPFC.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply basic circuit knowledge on calculating voltage-current for transmission and distribution system
- CO2 - Evaluate transmission line parameters for single and three phase system.
- CO3 - Analyze the performance of over head transmission line
- CO4 - Design the overhead transmission line on mechanical aspect and estimate the performance parameters of line insulator and cables
- CO5 - Develop compensation techniques for transmission line using FACTS devices.
- CO6 - Examine the economic aspects of high voltage transmission (AC and DC).

TEXT / REFERENCE BOOKS

1. C. L. Wadhwa, "Electrical Power Systems", 6th edition, New Age International (P) Limited, New Delhi, 2010.
2. V. K. Metha & Rohit Metha, "Principles of Power System", S. Chand, 3rd edition, 2006.
3. S. L. Uppal, Electrical Power, Khanna Publishers, New Delhi, 2006.
4. Chakrabarti, A, Soni M I, Gupta P V, "Textbook on power system engineering", Dhanpat Rai & Co, 2008.
5. S.N.Singh, "Electric Power Generation, Transmission & Distribution", Prentice Hall of India, New Edition, New Delhi, 2008.
6. Soni, Bhatnagar and Gupta, "Electrical Power", Dhanpat Rai & Sons, New Delhi, 2006.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1205	AC MACHINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge on construction and performance of salient and non - salient type synchronous generators.
- To study the principle of operation and performance of synchronous motor.
- To familiarize on performance, starting and speed control of three-phase induction motors.
- To study the working principle of various single-phase induction motors

UNIT 1 SYNCHRONOUS GENERATORS

10 Hrs.

Constructional features - EMF Equation - Armature Reaction - Synchronous Reactance - Voltage Regulation - Synchronous Impedance Method - MMF and Potier Methods - Synchronising & Parallel Operation - Two Reaction Theory - Determination of X_d and X_q (Slip test).

UNIT 2 SYNCHRONOUS MOTORS

9 Hrs.

Principle of Operation - Starting Methods - Effect of Increased Load with Constant Excitation - Effect of Changing Excitation on Constant Load - Different Torque - Power flow equation - Phasor diagram - V and inverted V curves - Hunting and suppression methods.

UNIT 3 THREE PHASE INDUCTION MOTORS

9 Hrs.

Construction - Types of 3- Phase Induction Motors - Rotating Magnetic Fields - Torque Equation - Condition for Maximum Torque - Slip, Torque Slip Characteristics - Power Stages in Induction Motors - Losses and Efficiency - Plugging - Cogging and Crawling - Concept of Induction Generator.

UNIT 4 CIRCLE DIAGRAM AND CONTROL METHODS OF 3- PHASE INDUCTION MOTOR

9 Hrs.

No load and Blocked rotor tests - Equivalent circuit - Construction of Circle diagram - Starting methods - Speed control - Double cage Induction motor.

UNIT 5 SINGLE PHASE AC MOTORS

8 Hrs.

Double Field Revolving Theory - Types of Single Phase Induction Motor - Equivalent Circuit (Qualitative) - Repulsion Motor - Series Motor - Universal motor, AC Servomotor, Linear Induction Motor, Hysteresis motor.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply a suitable methodology to identify the voltage regulation of a Synchronous Generator
- CO2 - Analyze the operation of synchronous motor under various excitation conditions
- CO3 - Design motor parameters to obtain maximum efficiency of the three phase induction motor
- CO4 - Investigate the motor parameters to control the speed of three phase induction motor
- CO5 - Categorize various types of single phase induction motor with equivalent circuit
- CO6 - Select a suitable AC motor for Real World Problems

TEXT / REFERENCE BOOKS

1. A K Theraja & B L Thereja, "A Text book of Electrical Technology (Vol II)", S Chand & Co- 23rd Edition 2008.
2. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.
3. A.E. Fitzgerald, Charles Kingsley, Stephen. D.Umans, 'Electric Machinery', Tata Mc Graw Hill publishing Company Ltd, 2003.
4. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
5. Charless A. Gross, "Electric /Machines, "CRC Press, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SCS4201	OBJECT ORIENTED PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Develop a C++ program to implement a class, object creation, member function invocation concept.
2. Develop a C++ program to implement the various constructors and destructor concept
3. Develop a C++ program to implement a friend function, Inline function.
4. Develop a C++ program to implement an operator (Unary & Binary) overloading concept.
5. Develop a C++ program to implement a function overloading concept.
6. Develop a C++ program to implement a run time polymorphism.
7. Develop a C++ program to implement the following inheritance types:
 - a. Single
 - b. Multiple
 - c. Multilevel
 - d. Hierarchical
 - e. Hybrid
8. Develop a C++ program to implement an Abstract class concept.
9. Develop a C++ program to implement a Virtual function.
10. Develop a C++ program to find the number of characters in a file
11. Develop a C++ program to handle the exceptions.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Design object-oriented paradigm with concepts of streams, classes, functions, data and objects.
- CO2 - Develop a Program to initialize and destroy objects using Constructor, destructor function.
- CO3 - Build a program using the concepts of function overloading and operator overloading.
- CO4 - Implement Inheritance concept in real time applications..
- CO5 - Construct programs using Abstract Class and Virtual function.
- CO6 - Create an application using C++ for implementing File and Exceptional Handling

SEE4054	AC MACHINES LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Regulation of Alternator by EMF and MMF method
2. Regulation of Alternator by Potier method
3. Regulation of salient pole Alternator by slip test
4. Load test on 3 phase Alternator
5. Synchronizing and parallel operation of three phase Alternator with infinite bus bar
6. V curve and inverted V curves of synchronous motor
7. Brake load test on Three phase squirrel cage induction motor
8. Load test on Three phase slip ring induction motor
9. Load test of Single phase induction motor
10. Equivalent circuit of Single phase induction motor
11. Circle diagram and performance of Three phase induction motor
12. Study on Characteristics of induction generator

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Evaluate the voltage regulation of alternator with different indirect method
- CO2 - Analyze the voltage regulation of alternator with various load.
- CO3 - Develop the synchronization circuit for alternator
- CO4 - Analyze the performance characteristics of Induction motor.
- CO5 - Examine performance characteristics of single phase induction motor
- CO6 - Analyze the characteristics of asynchronous machine.

SEC1302	ANALOG INTEGRATED CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To comprehend the concepts of Op-Amp and its application
- To study the various Filters and signal generators
- To acquire knowledge about ADC and DAC
- To study the basic principles of PLL and Timer Circuit
- To understand the concept of Special function ICs

UNIT 1 INTRODUCTION TO OP- AMP AND ITS APPLICATIONS

9 Hrs.

OP-AMP– DC and AC Characteristics- Input offset voltage- Input bias current-Input offset current- Total output offset voltage- Thermal drift- Slew rate- CMRR -Inverting amplifier- Non-inverting amplifier- Voltage follower- Summing and differential amplifier- Integrator- Differentiator- Logarithmic and Anti logarithmic amplifiers-Comparator and Schmitt trigger

UNIT 2 FILTERS AND SIGNAL GENERATORS

9 Hrs.

First order and Second order Butterworth filters- low pass, high pass, band pass and band reject filters –RC phase shift, Wein's bridge oscillator- Astable and Monostablemultivibrator-Precision half wave and full wave rectifiers.

UNIT 3 A/D AND D/A CONVERTERS

9 Hrs.

Sample and Hold circuit – Digital to analog converters: R-2R ladder network and Binary weighted – Characteristics of D/A converters – Analog to digital converters: Flash converter – Successive approximation converter – Dual slope ADC.

UNIT 4 PLL AND TIMER CIRCUITS

9 Hrs.

Phase Locked Loop IC 565– Block schematic – Applications of PLL: FM demodulator and Frequency synthesizer-FSK Demodulator- VCO IC LM 566 – Timer IC LM 555 and its applications: Astable and Monostable multivibrator

UNIT 5 SPECIAL FUNCTION ICs

9 Hrs.

Integrated circuit Tuned amplifier, Instrumentation Amplifier, Series and shunt voltage regulator, Opto coupler, CMOS Operational Amplifier- Dc analysis- small signal analysis- specifications of IC MC 14573.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Interpret the DC-AC Characteristics and applications of Operational Amplifier
- CO2 - Design the Active filters using OP-AMP
- CO3 - Develop a voltage controlled oscillator for PLL application.
- CO4 - Examine the applications of special function IC's namely voltage Regulator and 555 timer
- CO5 - Analyze ADC and DAC for Real time Implementation
- CO6 - Implement a research oriented application using OPAMP

TEXT / REFERENCE BOOKS

1. Ramakant A.Gayakwad, OP-AMP and Linear ICs, 4th Edition, Prentice Hall / Pearson Education, 1994.
2. D.Roy Choudary, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000.
3. Grey and Meyer, Analysis and Design of Analog Integrated Circuits, 4th Edition, Wiley International, 2001.
4. Michael Jacob, Applications and Design with Analog Integrated Circuits, 2nd Edition, Prentice Hall of India, 1993.
5. S. Salivahanan, V.S. KanchanaBhaaskaran, linear integrated circuits, 3rd Edition, McGraw-Hill, 2011.
6. William D.Stanely, Operational Amplifiers with Linear Integrated Circuits, 4th Edition, Pearson Education, 2004.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SIC1203	MEASUREMENTS AND INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge in the area of electrical and electronic instruments with the in-depth knowledge about the construction and the working of the instruments.
- To expose the student about measurement of voltage, current, resistance, inductance, capacitance, power, energy and data acquisition concepts

UNIT 1 BASIC MEASUREMENTS

9 Hrs.

Methods of Measurement, Measurement System, Classification of instrument system, Functional Elements of measurement system - Examples - Characteristics of instruments: Static characteristics - Dynamic characteristic Types of errors - sources of errors - methods of elimination - Analysis of data - Limiting errors - Relative limiting error - Combination of Quantities with limiting errors - Statistical treatment of data: Histogram, Mean, Measure of dispersion from the mean, Range, Deviation, Average deviation, Standard Deviation, Variance - Calibration and Standards - Process of Calibration.

UNIT 2 ELECTRICAL MEASUREMENTS

9 Hrs.

Units of voltage and current - principle of operation of D'Arsonval Galvanometer - principle, operation, constructional details and comparison of the following: permanent magnet moving coil, permanent magnet moving iron, Dynamometer, Induction, thermal and rectifier type instruments, Power measurement - Voltmeter ammeter method, Ammeter voltmeter method, Electro-dynamic wattmeter - Low power factor wattmeter

UNIT 3 MEASUREMENT OF RESISTANCE, INDUCTANCE AND CAPACITANCE

9 Hrs.

Low Resistance: Kelvin's double bridge - Medium Resistance: Voltmeter Ammeter method - Substitution method - Wheatstone bridge method. High Resistance: Megger - Direct deflection method - Megohm bridge method, Loss of Charge method - Earth resistance measurement. Introduction to A.C bridges Sources and Detectors in A.C. bridges. Measurement of Self Inductance: Maxwell's bridge - Hay's bridge, and Anderson's bridge. Measurement of Mutual Inductance: Heavy side M.I bridge - Measurement of Capacitance: Schering's bridge - Sauty's bridge, Measurement of frequency using Wien's bridge.

UNIT 4 ELECTRONIC MEASUREMENTS

9 Hrs.

Fundamentals of Cathode Ray Oscilloscope: Block diagram, CRO probes, Delay line, types of Oscilloscopes. Measurement of: Signal voltage, Current, Phase & Frequency using Lissajous patterns, Industrial applications of CRO. DC and AC voltmeter and Ammeter, Ohmmeter, Range Extension, Electronic Multimeters, Types of Voltmeters - Differential type, true RMS type, Vector voltmeter - Wave Analyzer, Spectrum Analyzer and Distortion Analyzer

UNIT 5 DATA ACQUISITION

9 Hrs.

Introduction to ADC / DAC - Specifications, ADC Quantization Error, Types of ADC - Flash, Counter, Successive Approximation, Dual-Slope types and Introduction to Delta-Sigma, Types of DAC - Weighted-Resistor, 2R ladder and PWM type, ADC and DAC Problems - Smart sensors.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Describe the concepts of measurement systems and characteristics of instruments
- CO2 - Describe the construction and working of various types of instruments
- CO3 - Choose an appropriate instrument for the required measurement.
- CO4 - Analyze the various characteristics of signals
- CO5 - Design a suitable conversion circuit for an application
- CO6 - Design an instrument to measure electrical and electronic parameters

TEXT / REFERENCE BOOKS

1. Sawhney A.K., "A Course in Electrical, Electronic measurement & Instrumentation", Dhanpat Rai & sons, 1 8th Edition, Reprint 2010
2. Doebelin E.O. "Measurement System Applications and Design", McGraw Hill, 5th Edition, 2004.
3. Albert D. Helfrick & William, D. Cooper, "Modern Electronic Instrumentation & Measurement Techniques", PHI, 2003.
4. Chris Nadovich, 'Synthetic Instruments Concepts and Applications', Elsevier, 2005.
5. Rick Bitter, Taqi Mohiuddin and Matt Nawrocki, 'Labview Advanced Programming Techniques', CRC Press, Second Edition, 2007.
6. Rahman Jamal and Herbert Picklik, "LabVIEW - Applications and Solutions", National Instruments Release ISBN 0130964239.
7. Gupta J.B., "A course in Electrical and Electronic Measurement and Instrumentation", 12th Edition, Katson Publishing House, 2003.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEC1310	MICROPROCESSOR INTERFACING AND ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To enhance the idea of computer architecture, Assembly language programming and interfacing of various peripherals for system design, two different processors such as 8085 and 8086 were incorporated

UNIT 1 8085 MICROPROCESSOR

9 Hrs.

8085 Architecture- Timing Diagram- Interrupts-Addressing Modes- Instruction Formats- Instruction Set Programming of 8085.

UNIT 2 8086 MICROPROCESSOR

9 Hrs.

8086 Architecture- Maximum and Minimum Mode- Memory Banks- Memory Segmentation- Programming Model - Instruction Set- Programming of 8086.

UNIT 3 PERIPHERALS INTERFACING USING 8085/8086

9 Hrs.

Introduction, memory and I/O interfacing, data transfer schemes, programmable peripheral interface (8255), programmable DMA controller (8257), programmable interrupt controller (8259), Universal synchronous asynchronous receiver transmitter (USART) (8251), and programmable counter/interval timer (8254).

UNIT 4 INTERFACING CONCEPTS WITH 8085/8086

9 Hrs.

Switches- Matrix Keyboard- interfacing LED, 7 segment LED, LCD, Analog to Digital Converter (ADC), Digital to Analog Converter (DAC), Memory Interfacing (RAM and ROM)

UNIT 5 APPLICATIONS USING 8085/8086

9 Hrs.

Stepper motor interfacing with ULN2003- specific angle rotation, Motor speed control, Temperature control system, Traffic light control- 6V relay to control AC Bulb- PWM generation for Single phase controlled rectifier with specific firing angle

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Develop Assembly Language Program using Intel 8085 mnemonics for arithmetic logical and statistical formulae
- CO2 - Develop Assembly Language Program using Intel 8086 mnemonics for arithmetic logical and statistical formulae
- CO3 - Comprehend interfacing IC's for 8085 and 8086 Microprocessor
- CO4 - Develop Assembly Language Program for seven segment LED, ADC and DAC
- CO5 - Develop Assembly Language Program for real time applications using interfacing circuits
- CO6 - Compute the computational complexity of Assembly Language Program

TEXT / REFERENCE BOOKS

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming and applications with 8085", 6th Edition, Penram International Publishing Pvt Ltd, 2014.
2. Douglas V. Hall, "Microprocessor and its Interfacing", Tata McGraw Hill, Edited second Version.
3. Nagoor Kani A, "Microprocessor (8085) and its Applications", 2nd Edition, RBA publications.
4. Mathur A.P, "Introduction to Microprocessor", Tata McGraw Hill, 3rd Edition 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1301	ADVANCED CONTROL SYSTEMS	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To gain knowledge in designing of State Space Analysis
- To have an clear understanding in Digital Data Systems
- To have an exposure in different stability analysis of Nonlinear Systems

UNIT 1 STATE SPACE MODEL

11 Hrs.

Introduction to State Space, State Variables, Physical Variables, Phase Variables-Matrices, Eigen Values and Eigen vectors - Diagonalization, Canonical and Jordan forms - State Space Models from Differential Equations - Conversion of State Variable Models to Transfer Function

UNIT 2 MATHEMATICAL ANALYSIS

9 Hrs.

Computation of State Transition Matrix - Laplace Transformation Method, Canonical Transformation - Cayley Hamilton Theorem-Solution of State Equation.

UNIT 3 STATE FEEDBACK AND OBSERVERS

10 Hrs.

Concepts of Controllability and Observability - Design of State Space Feedback using Pole Placement Technique-State Observers.

UNIT 4 SAMPLED DATA SYSTEMS

15 Hrs.

Introduction to Digital Control - Discrete Time Signals - Sampling Process - Analysis of Sampling Process in the Frequency Domain - Spectral Representation - Analyzing - Shannon's Sampling Theorem - Reconstruction of Sampled Signals using Hold Circuits - Zero Order Hold - its Representation - Bode Plot of Hold Circuit - Z - Transform of Sampled Signals - Theorems on Z- Transform - Inverse Z-transform - Mapping between s and z Planes - Pulse Transfer Function Impulse Response - Closed Loop Operation - Characteristic Equations - Jury's Stability Criterion.

UNIT 5 NONLINEAR SYSTEMS

15 Hrs.

General Properties of Non-Linear Systems - Describing Function Method - On / Off, Dead Zone, Saturation and Hysteresis Non Linearities - Determination of Limit Cycle by Describing Function - Stability of Limit Cycle - System Stability in the Sense of Lyapunov - Lyapunov's Direct Method - Stability and Instability Theorems - Application of Lyapunov Method for Linear Systems - Basic Concepts of Phase Plane Method.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Develop state model for any linear time invariant system..
- CO2 - Analyse the state transition matrices and their solutions for linear time invariant systems.
- CO3 - Design a state observer using pole placement technique.
- CO4 - Investigate the stability of LTI system in discrete domain.
- CO5 - Develop the describing function of non linear systems
- CO6 - Determine the stability of linear systems using lyapunov

TEXT / REFERENCE BOOKS

1. K.Ogata, "Modern control Engineering", 5th Edition. Prentice Hall India, New Delhi. 2010.
2. B.C.Kuo, "Automatic Control Systems", Phi learning Pvt Ltd, 9th Edition, 2009.
3. Philips C.L., & John Parr "Feedback Control Systems" 5th Edition, Prentice Hall International. 2010.
4. Naresh K. Sinha, "Control Systems", New Age International Ltd., Reprint 2004.
5. Stanley M.Shinners, "Modern Control System Theory and Design", 2nd Edition, John Wiley & Sons. 1998.
6. M.Gopal, "Digital Control and State Variable Methods", 4th Edition, Tata McGraw Hill Ltd., New Delhi, 2012.
7. Roy Choudhry, "Modern Control Engineering" Phi Learning, 2009

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1302	POWER SYSTEM ANALYSIS	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To impart knowledge in modelling of power system elements
- To implement Numerical methods in power flow problem
- To analyze the system in various faulted conditions.
- To have a knowledge in stability and security of power systems

UNIT 1 POWER SYSTEM MODELING

14 Hrs.

Need for system analysis in planning and operation of power system - per phase analysis of symmetrical three-phase system. General aspects relating to power flow, short circuit and stability analysis - Modeling of generator, load, shunt capacitor, transmission line, shunt reactor for short circuit, power flow and stability studies -per unit representation - bus admittance by analytical method and direct inspection method.

UNIT 2 POWER FLOW ANALYSIS

10 Hrs.

Problem definition - bus classification - derivation of power flow equation - solution by Gauss Seidel and Newton Raphson methods by polar form - P V bus adjustments for both methods - computation of slack bus power, line flow and transmission loss.

UNIT 3 SYMMETRICAL SHORT CIRCUIT ANALYSIS

12 Hrs.

Need for short circuit study - Bus impedance matrix formation - Symmetrical short circuit analysis using Z-bus. - computations of short circuit capacity, post fault voltage and current.

UNIT 4 UNSYMMETRICAL SHORT CIRCUIT ANALYSIS

12 Hrs.

Symmetrical component transformation - sequence impedances.- Sequence Networks - unsymmetrical short circuit analysis for single line fault, line to line fault and double line to ground fault using Z-bus - computations of short circuit capacity, post fault voltage and current.

UNIT 5 STABILITY & SECURITY ANALYSIS

12 Hrs.

Distinction between steady state and transient state - Concepts of Stability & Security - Swing equation-solution to swing equation - step by step method - power angle equation - equal area criterion - critical clearing angle and time. Stability analysis of single machine connected to infinite bus by modified Euler's method - Multi-machine stability analysis using Runge Kutta method.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Model Impedance, Reactance networks and develop bus admittance matrix.
- CO2 - Examine load flow in a power grid using bus admittance matrix.
- CO3 - Examine fault currents and post fault voltages in symmetrical short circuit using bus impedance matrix.
- CO4 - Estimate fault currents and post fault voltages in unsymmetrical short circuit using symmetrical components.
- CO5 - Evaluate the stability conditions in power grid for minor and major disturbances.
- CO6 - Develop the mathematical solution for achieving stability in power grid during transient state.

TEXT / REFERENCE BOOKS

1. John J. Grainger and Stevenson Jr. W.D., "Power System Analysis", Tata McGraw Hill, 2017.
3. Kothari .D.P and Nagarath .I.J., "Power system Engineering", 2nd Edition, Tata McGraw Hill, 2011.
4. Stagg, G.W. and El-Abaid, A. H. "Computer Methods in Power System Analysis", McGraw-Hill International Book Company, 1994.
5. Nagarath, I.J., and Kothari, D.P., "Modern Power System Analysis", 4th Edition, Tata McGraw Hill Publishing Company, 2011.
6. Hadi Saadat, "Power system Analysis", Tata McGraw Hill Publishing Company, 3rd Edition, 2011.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1304	ELECTRICAL MACHINE DESIGN	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To study the mmf calculations for air gap and iron paths of rotating machines
- To design the armature and field for dc machines
- To design the core and windings and cooling systems for transformers
- To design the stator and rotor for induction machines and synchronous machines

UNIT 1 BASIC CONCEPTS OF DESIGN

12 Hrs.

Major considerations in Machine design - Limitations in design - Standard specifications - Electrical Engineering materials - High conductivity materials - Insulating materials - Magnetic circuit calculations - mmf for airgap and iron path - real and apparent flux densities in rotating machines - Choice of specific electric and magnetic loadings.

UNIT 2 DC MACHINES

14 Hrs.

Output equation - Main Dimensions - Choice of number of poles - Armature design - Estimation of number of conductors / turns - Coils armature slots- Conductor dimensions - Slot dimension - Design of field poles and field coil (shunt field) - Design of Commutators and Brushes

UNIT 3 TRANSFORMERS

12 Hrs.

Output equation - Design of core and winding of single phase shell and core type transformer and three phase transformers -Temperature rise in transformers - Design of tank, cooling tubes and Ducts

UNIT 4 THREE PHASE INDUCTION MACHINES

12 Hrs.

Output equation, Main dimensions, Design of stator, Choice of L/D ratio - Air gap length - Design of rotor - squirrel cage and slip ring rotor.

UNIT 5 SYNCHRONOUS MACHINES

10 Hrs.

Output equation - Design of salient pole rotor machine - Dimensions - Short circuit ratio - Effect of Short Circuit ratio - Air gap length - Armature design - Slot dimensions - Rotor design - Design of damper winding - Design of cylindrical rotors

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyze the magnetic circuits for rotating machines based on the major design considerations
- CO2 - Design a DC machine for the given specific loadings.
- CO3 - Design the dimensions of core, winding and cooling tubes in a transformer
- CO4 - Design the dimensions of stator and rotor of induction machine
- CO5 - Design the dimensions of stator core and winding of synchronous machines.
- CO6 - Design the salient and cylindrical rotor of synchronous machines.

TEXT / REFERENCE BOOKS

1. A.K.Sawhney, A.Chakrabarti, "A course in Electrical machine Design", Dhanpat Rai and Sons, New Delhi, 6th Edition, 2010.
2. Albert E. Clayton and NN Hancock, "The performance and Design of Direct Current Machines", Oxford and IBH Publishing Co. Pvt.Ltd., New Delhi, Edition 2004.
3. A.Nagoorkani, "Electrical Machine Design", RBA Publications, 2nd Edition, 2014.
4. R.K.Agarwal, "Principles of Electrical Machine Design", Fifth edition, S.K.Kataria & Sons.. 2014.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEC4054	INTEGRATED CIRCUITS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

ANALOG INTEGRATED CIRCUITS

- Design and construct using IC741
 - Inverting
 - Non-inverting
 - Adder
 - Schmitt Trigger
 - Differentiator
- Waveform Generators using IC741
 - Triangular wave generator
 - Square wave generator
 - Sine Wave generator
- Design and construct PWM using IC 555 timer
- Design a 3 bit DAC in R-2R ladder Configuration
- Design, construct the filters using PSPICE
 - Low pass filter
 - High pass filter
 - Band pass filter
 - Band reject filter

DIGITAL CIRCUITS

- Verify the Basic gates / Boolean function using logic gates.
- To Construct and verify the full and half adder using logic gates.
- To Verify 2x4 Decoder and 4x2 Encoder functionally.
- To construct and study the working of RS flip-flop, D flip-flop, T flip-flop, JK flip-flop
- To verify various shift register
 - SISO
 - SIPO
 - PISO
 - PIPO
- Design a counter using suitable flip-flop
 - MOD Counter
 - Ripple Counter
 - Up- Down Counter

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Design the circuits for linear and nonlinear applications of Op amp.
- CO2 - Build a data converter and pulse generator circuit.
- CO3 - Simulate different types of filters using OrCAD Pspice..
- CO4 - Verify the truth table of logic gates and state table of sequential circuits.
- CO5 - Construct the combinational circuits using logic gates.
- CO6 - Develop different types of counters by implementing flip-flops.

SEC4068	MICROPROCESSOR LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Programs for 8 bit Addition, Subtraction, Multiplication and Division.
2. Perform 32 bit Addition of two numbers.
3. Counting numbers of 1's in given word.
4. Arithmetic mean of Square of N Numbers.
5. Code Conversion – BCD to ASCII Conversion, ASCII to BCD Conversion.
6. Finding largest & smallest of given 16 bit Numbers.
7. To Sort given set of Numbers in Ascending & Descending Order.
8. Program using look up table Concept.
9. Matrix Manipulation – 16 bit addition.
10. Perform LCM of two 16 bit numbers, GCD of four 16 bit numbers.
11. Generate Fibonacci Series, Factorial of given Numbers.
12. Interfacing 8086 with Stepper motor. Use Step angle Calculation & rotate motor to a Specified angle.
13. Interface 8086 with DC motor & Control the Speed of the DC Motor using PWM.
14. Interface 8086 With ADC & display the digital input, Perform the resolution calculation and cross verify the result.
15. Interface 8086 With DAC & display the following waveform in CRO. a). Triangular b). Saw tooth c). Staircase.
16. Interface 8086 with 7 segment display to display numbers as Characters.
17. Interface 8086 with LCD to display the name of the person.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Select appropriate instruction set for solving arithmetic and logical operation using 8085 / 8086 microprocessor.
- CO2 - Construct codes to perform array addition & sorting operations using 8086.
- CO3 - Develop ALP to solve mathematical problems like GCD, LCM, Factorial and Fibonacci using 8086.
- CO4 - Construct ALP to perform code conversion using 8086.
- CO5 - Connect appropriate interfaces for controlling the drives using 8086.
- CO6 - Develop ALP to interface the various digital displays.

SEC1315	DIGITAL SIGNAL PROCESSING & ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart basic ideas in signals and systems
- To give basic idea of Analog and Digital filter design with various structures of realizing it.
- To learn about the effects of finite word length in signal processing
- To learn a DSP controller pertaining to Power Electronics via Programming.

UNIT 1 SIGNALS, SYSTEMS & TRANSFORMS

9 Hrs.

Sampling theorem- Aliasing-Classifications of Signals and Systems - Review of Z transform & Inverse Z Transform-ROC - Time and frequency response analysis using standard test signals (step and ramp) - Convolution- Correlation -DTFT- DFT- Properties of DFT- FFT computations using Decimation algorithms.

UNIT 2 DESIGN OF INFINITE IMPULSE RESPONSE FILTER (IIR)

9 Hrs.

Design of IIR filters using Impulse invariant and Bilinear transformation method- Prewarping. Review of Butterworth and Chebyshev approximations- Frequency transformation in analog domain- Filter design using butterworth and chebyshev- Realization of recursive structures-Direct form-I-Direct form-II-Cascaded-Parallel Form.

UNIT 3 DESIGN OF FINITE IMPULSE RESPONSE (FIR) FILTER

9 Hrs.

Properties of IIR and FIR filters - Filter design using windowing techniques - Hamming, Hanning, Blackman, Rectangular, Triangular windows- Digital filter design using Frequency sampling technique- Realization of Structures for FIR and Linear phase FIR filter- Direct form-Transposed form- Cascaded form.

UNIT 4 FINITE WORDLENGTH EFFECTS

9 Hrs.

Finite word length effect- Quantization- Truncation, Rounding-Quantization error- Input quantization error- Coefficient of quantization- Product quantization- Limit Cycle oscillations- Overflow- Signal scaling.

UNIT 5 TMS320C2407 DSP CONTROLLER & PROGRAMMING FOR POWER ELECTRONICS APPLICATIONS

9 Hrs.

Nomenclature- TMS 320 family overview -Architectural Overview-Central Processing unit – Addressing modes- Event Manager- General purpose timers (GPR)- Full compare Unit (FCU)- Dead band unit- simple programs for PWM generation using GPR and FCU pertaining to Power electronic applications.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyze Discrete time signal and systems using various transforms.
- CO2 - Design IIR filter using Butterworth and Chebyshev approximation Techniques.
- CO3 - Design FIR filter using windowing and frequency sampling techniques.
- CO4 - Investigate the effects of finite word length effect on filters.
- CO5 - Comprehend the architecture of digital signal processing controller (TMS320CX2407).
- CO6 - Develop ALP for motor control application using TMS320CX2407.

TEXT / REFERENCE BOOKS

1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", Fourth edition,Pearson education / Prentice Hall, 2007
2. Emmanuel C..Ifeachor, & Barrie.W.Jervis, "Digital Signal Processing", Second edition, Pearson Education / Prentice Hall,2002.
3. Alan V.Oppenheim, Ronald W. Schafer & Hohn. R.Back, "Discrete Time Signal Processing", Pearson Education, 2nd edition,2005.
4. Andreas Antoniou, "Digital Signal Processing", Tata McGraw Hill, 2001.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1305	POWER ELECTRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

To understand the various applications of electronic devices for conversion and control of the electrical power.

UNIT 1 POWER SEMICONDUCTOR DEVICES

9 Hrs.

Overview of V-I characteristics of switching devices - Switching characteristics of Power Diode, BJT power MOSFETS, IGBT and Thyristor - SCR Protection circuits - Thyristor Turn-ON methods - firing circuits - Commutation techniques.

UNIT 2 PHASE CONTROLLED RECTIFIERS

10 Hrs.

Principle of phase controlled converter operation - single phase half wave converter, semi converter & full converter with R, RL & RLE load - Freewheeling diode - Inverter operation of full converter - Three phase Semi converter & full converter with RL load.

UNIT 3 DC & AC CHOPPERS

9 Hrs.

DC - DC Chopper: Principle of operation of Step down and step up choppers - Control Strategies - One, Two and Four quadrant operation. AC - AC Chopper: Single phase AC voltage controllers with R & RL load - Multistage sequence control. Single phase step up and step down cycloconverters.

UNIT 4 INVERTERS

9 Hrs.

Principle of operation: Single phase half bridge & full bridge voltage source inverters - Three phase Voltage source inverters (120° and 180° mode) - Single phase current source inverter. PWM techniques: Single pulse PWM, Sinusoidal PWM, Modified sinusoidal PWM and multiple PWM

UNIT 5 APPLICATIONS

8 Hrs.

SMPS: Flyback and Push Pull - UPS: Redundant and Non-Redundant - HVDC Transmission systems - Single phase full converter fed DC drives - Inverters for standalone photovoltaic systems

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Identify the appropriate power semiconductor devices for Electrical power conversion.
- CO2 - Analyze Phase Controlled Rectifiers for various Electrical Loads.
- CO3 - Design DC chopper and AC voltage controllers for various Electrical loads.
- CO4 - Evaluate the inverters based on the pulse width modulation techniques.
- CO5 - Develop Power Electronic Converters to enhance the performance of Renewable Energy Sources.
- CO6 - Design power electronics circuits for High Voltage applications..

TEXT / REFERENCE BOOKS

1. Rashid M.H., "Power Electronics circuits Devices and Applications", Prentice Hall, 3rd Edition, New Delhi, 2013
2. P.S.Bimbhra, "Power Electronics", Khanna Publishers, 4rd Edition, 2017
3. P.C.Sen, "Power Electronics", Tata Mc Graw Hill Company, New Delhi, 2015.
4. M.D.Singh and K.B.Khanchandani, "Power Electronics" TMH, New Delhi, 2nd Edition, 2008.
5. Ned Mohan, "Power Electronics", 3rd Edition, 2010

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1306	ELECTRIC DRIVES AND CONTROL	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

To understand the operations of electrical machines controlled by power electronic converters and its applications.

UNIT 1 DRIVES CHARACTERISTICS

9 Hrs.

Electric drives - Advantages - choice of electric drive, Speed/Torque Characteristics of various types of loads and drive motors, Classes of motor duty- selection of power rating for drive motors with regard to duty. Thermal model of motor for heating and cooling, Overloading and load variation factors- load equalization.

UNIT 2 DC DRIVE

9 Hrs.

Starting and braking operations of dc motor drive-Speed control of DC motors - Ward Leonard scheme - Drawbacks - Ward Leonard Ilgener scheme - Thyristor converter fed DC Drives: single, two and four quadrant operations. Chopper fed DC Drives: control strategies - single, two and four quadrant operation.

UNIT 3 THREE PHASE INDUCTION MOTOR DRIVES

9 Hrs.

Starting and braking operations of dc motor drive-Speed control of DC motors - Ward Leonard scheme - Drawbacks - Ward Leonard Ilgener scheme - Thyristor converter fed DC Drives: single, two and four quadrant operations. Chopper fed DC Drives: control strategies - single, two and four quadrant operation.

UNIT 4 THREE PHASE SYNCHRONOUS MOTOR DRIVES

9 Hrs.

Speed control of three phase synchronous motors - types of control , Voltage source and current source converter fed synchronous motors -Cycloconverter fed synchronous motors -Commutatorless DC motor- Effects of harmonics on the performance of AC motors -Closed loop control of drive motors, Marginal angle control and power factor control.

UNIT 5 DIGITAL CONTROL AND DRIVE APPLICATIONS

9 Hrs.

Control of electric drives using microprocessor - Selection of drives and control schemes for steel rolling mills, Paper mills, textile mills and cranes.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply various types of loads to drive the motors.
- CO2 - Apply various power electronic converters for controlling speed dc drives.
- CO3 - Analyze torque, speed and position controller of induction motor drives.
- CO4 - Analyze different type of converter for synchronous motor drives
- CO5 - Examine the speed control of electrical machine in an industrial application.
- CO6 - Develop the embedded controller for industrial drives

TEXT / REFERENCE BOOKS

1. Gopal K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.
2. Gopal K. Dubey, "Fundamentals of Electrical Drives", Alpha Science International Ltd, 2010.
3. Vedam Subramanyam, "Thyristor control of Electric Drives", Tata Mc Graw Hill, New Delhi 1991.
4. S.K.Pillai, "A First Course on Electrical Drives", New age international Publishers Pvt Ltd, 1989, Reprint 2012.
5. P.C.Sen, "Thyristor DC Drives", John Wiley & Sons New York 1991.
6. B.K.Bose, "Power Electronic & AC drives", Prentice Hall, 2006
7. S.K.Pillai, "A First Course on Electrical Drives", New age international Publishers Pvt Ltd, 1989, Reprint 2012.
8. Rashid M.H., "Power Electronics circuits Devices and Applications", Prentice Hall, 3rd Edition, New Delhi, 2013.
9. <http://ecmweb.com/power-quality/effects-harmonics-power-systems>.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1307	SPECIAL ELECTRICAL MACHINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To study the concepts of stepper motors and its applications
- To study the operating principle and characteristics of switched reluctance motors
- To impart knowledge on the fundamental concepts and control of permanent magnet brushless DC motors
- To introduce the concepts and control methods of permanent magnet brushless synchronous motors and synchronous reluctance motors.

UNIT 1 STEPPING MOTORS

9 Hrs.

Constructional features, principle of operation, types, modes of excitation, Torque production in Variable Reluctance (VR) stepping motor, Static and Dynamic characteristics, Introduction to Drive circuits for stepper motor, suppressor circuits, Closed loop control of stepper motor- Applications.

UNIT 2 SWITCHED RELUCTANCE MOTORS

9 Hrs.

Principle of Operation, Constructional features, Torque equation, Power Semi Conductor Switching Circuits, frequency of variation of inductance of each phase winding - Control circuits of SRM-Torque - Speed Characteristics, Microprocessor based control of SRM Drive, Applications.

UNIT 3 SYNCHRONOUS RELUCTANCE MOTORS

8 Hrs.

Constructional features: axial and radial air gap Motors. Operating principle, reluctance torque - Phasor diagram, Speed torque characteristics, Applications.

UNIT 4 PERMANENT MAGNET BRUSHLESS DC MOTORS

9 Hrs.

Commutation in DC motors, Electronic Commutation- Difference between mechanical and electronic commutators Hall sensors, Optical sensors, Construction and principle of PMBL DC Motor, Torque and E.M.F equation, Torque-speed characteristics, Power Controllers-Drive Circuits, Applications.

UNIT 5 PERMANENT MAGNET SYNCHRONOUS MOTORS

10 Hrs.

Construction and types, Principle of operation, EMF and Torque equation, Phasor diagram- Torque Speed Characteristics, Power controllers- Self control, Vector control, Microprocessor based Control, Applications.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Comprehend the operation of various types of stepper motors.
- CO2 - Analyze the operation and characteristics of switched reluctance motors.
- CO3 - Evaluate the performance of synchronous reluctance motors..
- CO4 - Identify power controllers and driver circuits for permanent magnet brushless DC motor.
- CO5 - Justify best speed control for permanent magnet synchronous motor.
- CO6 - Develop control methods for Permanent magnet synchronous motor on real time applications.

TEXT / REFERENCE BOOKS

1. Miller, T.J.E. "Brushless permanent magnet and reluctance motor drives", Clarendon Press, Oxford, 1989.
2. Kenjo.T, "Stepping motors and their microprocessor control", Oxford University Press, 1995.
3. R.Krishnan, "Electric Motor Drives - Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., New Delhi, 2015.
4. Kenjo.T and Naganori, S "Permanent Magnet and Brushless DC motors", Clarendon Press, Oxford, 1989.
5. B.K. Bose, "Modern Power Electronics & AC drives", Dorling Kindersley India, 2006.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1303	POWER GENERATION AND UTILIZATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To Understand the general power generation concepts
- To Understand the general electrical utilization concepts
- To study the performance and efficiency of power generation

UNIT 1 CONVENTIONAL POWER PLANTS

10 Hrs.

Layout and working of diesel, steam, low and high head power plants-pumped storage plants-principle of nuclear power generation - types and layouts of nuclear reactors- boiling water reactor- advanced gas cooled reactor- fast breeder reactor - reactor control - waste disposal.

UNIT 2 ECONOMICS OF GENERATION

8 Hrs.

Introduction-Definitions-Load Duration Curve-Number and size of Generator Units-Base Load and Peak Load Plants-Cost of Electrical Energy-Fixed cost-Running Cost of Energy-Tariff or Charge to Consumer

UNIT 3 ILLUMINATION

10 Hrs.

Nature of radiation - definition-laws-lighting calculations-polar curves-Rousseau construction- design of Illumination Systems-Flood Lighting and Calculations-Street Lighting-Classification of Light Sources-Incandescent lamps- gas discharge lamps- sodium vapour, mercury vapour, Fluorescent Lamps and LED lamps.

UNIT 4 HEATING AND WELDING

8 Hrs.

Introduction - methods of heating - design of heating element- resistance, inductance, arc furnaces- high freq. dielectric heating- welding - types- resistance, arc welding- construction and its characteristics.

UNIT 5 ELECTRIC TRACTION

9 Hrs.

Introduction - requirements of an ideal traction Train Movement-Speed-Time Curve- mechanics of train movement - tractive effort calculations- Power and energy output from driving axles-Traction motors and its Characteristics-Traction motor control-Electric braking-Current collection systems

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Comprehend conventional power plants for modern Power Generation..
- CO2 - Analyze the economics of generation in terms of cost, number of generator, size of generator units and loads.
- CO3 - Design of Illumination Systems for various lighting systems.
- CO4 - Review the various methods of Heating and Welding used in power plants.
- CO5 - Evaluate the various Characteristics of Traction motors.
- CO6 - Develop the Electric Braking for Traction systems.

TEXT / REFERENCE BOOKS

1. C.L.Wadhwa, "Generation, Distribution & Utilisation of Electrical Energy", Wiley Eastern Ltd, New Delhi, 1993.
2. Uppal.S.L. "Electrical Power", Khanna Publishers, 9th Edition, 2001.
3. Starr A.T., "Generation, Transmission and Utilisation of Electric Power", ELBS, 1978.
4. Soni Bhatnagar & Gupta, "A Course in Electrical Power", Dhanpat Rai & Sons 1996
5. Openshaw Taylor, "Utilisation of Electrical Energy", Oriented Longmans Ltd, (Revised in SI Units) 1981, SI Edition.
6. Er.R.K.Rajput, "Utilization of Electrical power", Laxmi Publications,2006.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE4055	MEASUREMENTS AND CONTROLS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Measurement of self inductance by Maxwell's inductance bridge
2. Calibration of Ammeter, Voltmeter and Wattmeter.
3. Calibration of Three phase energy meter.
4. Instrumentation Amplifier
5. Study of LVDT and Pressure Transducer.
6. Design of P,PI and PID controller
7. Study of temperature measuring transducers (Thermocouple)
8. Transfer function of DC generator
9. Transfer function of Field controlled DC motor.
10. Transfer function of Armature controlled DC motor
11. Speed Control of Ward Leonard system.
12. Transfer function of lag, lead and lag- lead network.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Design an instrumentation Amplifier and Maxwell's Bridge.
- CO2 - Evaluate the basic meter and energy meter by calibrating the error.
- CO3 - Examine the physical parameters by using various transducers.
- CO4 - Design various controller and compensator for any applications.
- CO5 - Analyze the transfer functions of DC Motor.
- CO6 - Develop a method to vary the voltage and speed of DC motor.

SEE4056	POWER SYSTEMS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Computation of Power System Components in Per Units
2. Formulation of the bus admittance matrix by Direct Inspection method
3. Formulation of the bus admittance matrix by singular transformation method
4. Formation of bus impedance matrix
5. Analysis of Daily Load curve
6. Automatic Generation control
7. Determination of Transmission line parameters
8. Numerical Integration of swing equation
9. Load flow solution using Gauss – Seidel method
10. Load flow solution using Newton – Raphson method
11. Fault analysis
12. Characteristics of Microcontroller based frequency relay
13. Construction of simple ladder program for logic gates
14. Applications of Delay Timers in PLC
15. Applications of counters in PLC

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Model reactance network and develop bus impedance and bus admittance matrix.
- CO2 - Estimate the various faults currents in power system and compute inductance in Transmission lines
- CO3 - Solve the power flow analysis using Gauss seidel and N-R method
- CO4 - Analyze the daily load curve and automatic generation control
- CO5 - Determine the stability of system and characteristics of various relay
- CO6 - Design ladder diagram for different automation problem using PLC

SEC1317	PRINCIPLES OF EMBEDDED SYSTEM DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To impart knowledge about 8/ bit microcontroller, PIC microcontroller, comparison of CISC, RISC and Embedded system design

UNIT 1 8051 MICROCONTROLLER ARCHITECTURE

9 Hrs.

Comparison of microprocessors and microcontrollers - 8051 architecture - hardware, I/O pins, Ports, Memory, counters, timers, serial I/O interrupts.

UNIT 2 PROGRAMMING OF 8051

9 Hrs.

Addressing modes - instruction sets - simple programs with 8051 -I/O Programming.- Timer programmingSerial communication programs- Interrupt programming- Memory programming- Delay Programs.

UNIT 3 RISC EMBEDDED CONTROLLERS

9 Hrs.

Comparison of CISC and RISC controllers - PIC 16F877 architecture - memory organization - addressing modes - assembly language instructions- ARM 7 Architecture-Register organization- Modes and states.

UNIT 4 DISTRIBUTED EMBEDDED SYSTEM DESIGN

9 Hrs.

Distributed Embedded system - Embedded networking -RS 232 - RS485 - Inter-Integrated Circuit (I2C) - Serial Peripheral Interface (SPI) - Universal Serial Bus (USB) - Controller Area Network (CAN)- Ethernet.

UNIT 5 REAL TIME OPERATING SYSTEMS

9 Hrs.

Introduction - Desktop OS versus RTOs - Task management - Task scheduling - Race conditions - Priority Inversion - ISRs and Scheduling - Intertask Communication.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyze the pin details, register configurations, signals and architecture for 8051 microcontroller.
- CO2 - Develop an 8051 microcontroller based assembly language program to address engineering problems.
- CO3 - Develop assembly language program using PIC 16F877A Microcontroller to address engineering problems.
- CO4 - Select the suitability of various serial interfacing bus devices for applications.
- CO5 - Comprehend the performance of Real time operating system (RTOS) and non real time desktop operating system.
- CO6 - Develop an RTOS based real time embedded system.

TEXT / REFERENCE BOOKS

1. Kenneth. J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", Penram International, 1996, 2nd Edition.
2. Sriram. V. Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", 2004 Tata Mc Graw Hill Publishing company limited, 2006.
3. D.P.Kothari, ShriramK. Vasudevan, Subashri.V, Sivaraman Ramachandran, "Analysis of Microcontrollers", Scientific International Pvt Ltd, MEDTEC, ,1st Edition..
4. Frank Vahid, Tony Givargis, 'Embedded system Design - A unified Hardware / software Introduction', John Wiley and Sons,2002. .
5. Todd D Morton, 'Embedded microcontrollers', Reprint by 2005, Low Price Edition.
6. Muhammed Ali Mazidi, Janice Gillispie Mazidi, 'The 8051 Microcontroller and Embedded Systems', Low price Edition, Second Impression 2006.
7. Raj Kamal, 'Embedded Systems-Architecture, Programming and Design', Tata McGraw Hill Publishing company limited 2003.
8. Muhammed Ali Mazidi, rolin D.Mckinlay, Dannycasycy, " PIC microcontrollers and embedded systems using assembly and C", 1st edition, Pearson,2007.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1401	POWER SYSTEM PROTECTION AND SWITCHGEAR	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

To discuss the cause and effect of abnormal operating conditions in a Power system and the protective schemes along with the problems associated with circuit interruptions.

UNIT 1 INTRODUCTION DRIVES

8 Hrs.

Essential requirements of protection - nature and causes of faults - types of faults - effects of faults - zones of protection - protection schemes - CTs and PTs and their applications - Basic relay terminology.

UNIT 2 PROTECTIVE RELAYS

10 Hrs.

Electromagnetic relays - operating principle - torque equation - relay characteristics - over current relay, directional relay, distance relay, differential relay, negative sequence relay, amplitude and phase comparator of over current static relays, duality between comparators. Microprocessor based over current relay.

UNIT 3 APPARATUS PROTECTION

9 Hrs.

Protection of Generator- stator & rotor protection - Large Motor protection. Transformer protection - Bus bar Protection - Transmission line protection.

UNIT 4 THEORY OF ARC QUENCHING

9 Hrs.

Arcing phenomena - theory and methods of arc quenching - recovery voltage - restriking voltage - RRRV - Resistance switching - current chopping - capacitive current breaking - Characteristics of fuses - HRC fuse.

UNIT 5 CIRCUIT BREAKERS

9 Hrs.

Classification of circuit breakers - air circuit breakers - oil circuit breakers - vacuum circuit breaker - SF6 circuit Breakers - selection of circuit breakers - rating of circuit breakers - testing of circuit breakers.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Categorize various faults, their effects on power system and need of protection.
- CO2 - Analyze the various electromagnetic and static relay used in power system.
- CO3 - Design appropriate relay for various power system apparatus
- CO4 - Investigate various Arc quenching technique for power system protection
- CO5 - Evaluate the effectiveness of various circuit breakers with respect to Arc quenching
- CO6 - Examine the characteristics, rating and testing of circuit breakers

TEXT / REFERENCE BOOKS

1. Sunil S.Rao "Switchgear and protection", Khanna publishers, New Delhi, 2008.
2. Badri Ram and D.N.Vishwakarma "Power System Protection and Switchgear", Tata McGraw Hill publishing, New Delhi, 2005.
3. S.L.Uppal, "Electrical Power", Khanna publishers, New Delhi, 1995.
4. Soni, Gupta and Bhatnagar "A Course in Electrical power", Dhanpat Rai&sons, New Delhi, 2010.
5. TSM Rao, "Digital Numerical Relays", Tata McGraw Hill publishing, New Delhi, 2005.
6. B.Ravindranath and N.Chander, " Power System Protection and Switchgear", New age International (P) Ltd, 2005.
7. Dr.N.Veerappan and Dr.S.R.KrishnaMurthy, "Power System Switchgear and Protection", S.Chand, 2009.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEC4071	EMBEDDED SYSTEM DESIGN LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

EMBEDDED –

1. Basic illustration programs using arithmetic, Logical and bit oriented instructions for AT89C51
2. Interfacing light bulb using relay
3. Interfacing LCD display in static display
4. Interfacing stepper motor with ULN2003 to rotate in specific angle
5. Interfacing DC motor with H-bridge to make it rotate in front, back, left, right
6. Illustration of interrupts using LED on/off using timer delay
7. Illustration of serial communication to transfer data from one microcontroller to other

PROGRAMS USING MATLAB –

1. Generation of Standard Signals
2. Design of FIR filters using Windowing technique
3. Design of IIR Filters using Butterworth filters

USING TMS320CX2407 DSP PROCESSOR -

1. Single pulse fixed PWM generation using general purpose Timers.
2. Two pulse fixed PWM generation using Timer 1 and Timer 2.
3. Six pulse fixed PWM generation using full compare unit.
4. Six pulse fixed PWM generation with dead band

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Comprehend the statements of MATLAB and mnemonics of AT89C51.
- CO2 - Develop the code for arithmetic, logical and data transfer operations using AT89C51.
- CO3 - Develop the MATLAB program for signal generation/Processing applications.
- CO4 - Develop the code to generate PWM pulse using DSP processor.
- CO5 - Design IIR and FIR filter using MATLAB.
- CO6 - Design of microcontroller based embedded systems.

SEE4057	POWER ELECTRONICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. SCR Triggering Circuits
2. Single Phase Half & Fully Controlled Bridge Rectifier
3. SCR based series and Parallel Inverter
4. AC Regulator-Phase Control Using DIAC & TRIAC
5. Single phase Cycloconverter
6. MOSFET Based Buck & Boost Converter
7. IGBT Based Single Phase PWM Inverter
8. Voltage Commutated Chopper
9. Current Commutated Chopper
10. Complementary Commutated Chopper

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Choose a suitable triggering method of SCR and experiment on various firing and conduction angles.
- CO2 - Design rectifiers with R, RL and RLE loads for various firing angles.
- CO3 - Analyze AC output for different frequencies with Series and parallel inverter circuits using SCR.
- CO4 - Analyze ac voltage controller using SCR, DIAC, TRIAC
- CO5 - Develop hard wired circuit on various switching devices to analyze the variations in performances depending on their duty cycle..
- CO6 - Design different commutation circuits for real world problem.

SBA1101	PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To familiarize engineering students with the concepts of Management useful for Managing their own enterprise or to work in a professional organization in Managerial capacity and to provide them an ethical outlook.

UNIT 1 MANAGEMENT FUNCTIONS & STRUCTURE

9 Hrs.

Management - Definition -Role of managers- Levels of management-Basic Function - Contribution of Taylor & Fayol. Types of structures - Line, staff, Functional, Committee and Project & Matrix - Structures. Departmentalization - Centralization - Decentralization - Span of control. Management by Objectives (MBO)- Management by Exception (MBE).

UNIT 2 MANAGEMENT OF ORGANISATION

9 Hrs.

Forms of Business / Industrial Ownership - Sole Trader, Partnership, Joint stock Company, Performance Appraisal. Basic Principles - Pitfalls - Methods to Overcome. Industrial Safety - Causes of Accidents - Cost of Accidents - Measures to avoid Accidents. Plant Layout & Maintenance - Need, Types & Managerial Aspects

UNIT 3 ORGANISATIONAL BEHAVIOUR

9 Hrs.

Organizational Behaviour - Definition - Nature & Scope - Contributing Disciplines - Importance of OB to Managers. Personality - Definition - Theories - Factors Influencing Personality. Motivation - Definition - Theories. Transactional Analysis. Morale & Job Satisfaction - Factors Influencing Job Satisfaction.

UNIT 4 GROUP DYNAMICS

9 Hrs.

Group - Definition - Types - Determinants of Group Cohesiveness. Communication - Process - Barriers - Effective Communication. Leadership-Definition- leadership styles- Theories of leadership - Factors Contributing to Effective Leadership. Trade Unions- Role of Trade Union in Organizations - Types and Functions of Trade Unions

UNIT 5 PROFESSIONAL ETHICS

9 Hrs.

Ethics in Workplace - Formulation of Ethics - Managerial Ethics - Managing Ethical Behaviour - Codes of Ethics - Encouraging Ethical Behaviour - Ethical Leadership - Ethical Decision making. Corporate Social Responsibility (CSR) - Intellectual Property Rights (IPR)- Meaning- Laws relating to Intellectual Property Rights (IPRs)

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Comprehend various management principles and practices followed in industries
- CO2 - Analyze the types of business organization, plant layout and its safety measures.
- CO3 - Develop appropriate behavior as an individual and as a team to excel in industries.
- CO4 - Develop expertise knowledge on the impact of Leadership Communication and Group dynamics in industry
- CO5 - Comprehend the basics of ethical behaviour and corporate social responsibility practiced in industries
- CO6 - Investigate business cases by applying the ethical guidelines in industrial real life situations.

TEXT / REFERENCE BOOKS

1. Gupta C.B., "Management Theory and Practice", 14th Edition, Sultan Chand & Sons, 2009.
2. Dr. Prasad L.M., "Principle & Practice of Management", 7th Edition, Sultan Chand & Sons, 2008.
3. Aswathappa, "Organisational Behaviour", 8th Edition, Himalaya Publishing House, 2010.
4. Dr. Prasad L.M., "Organisational Behaviour", 4th Edition, Sultan Chand & Sons, 2008.
5. Harold Koontz, "Principles of Management", 1st Edition, Tata McGraw Hill, 2004.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1402	HIGH VOLTAGE ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

To impart knowledge on the concepts of over voltages, dielectric breakdown mechanisms and to emphasize the need for generation, measurement and testing of High voltages and currents.

UNIT 1 OVERVOLTAGES IN ELECTRICAL POWER SYSTEMS

9 Hrs.

Causes of Over voltages Theory and Mechanism of Lightning phenomenon - Overvoltage due to Switching Surges - Protection against over voltages - Reflection and Refraction of Travelling waves - Insulation Coordination.

UNIT 2 CONDUCTION AND BREAKDOWN IN DIELECTRICS

9 Hrs.

Ionization of gases and current growth - Townsend's criterion for breakdown -Streamer theory of breakdown in gases. Paschen's Law - Vacuum breakdown - Various mechanisms of breakdown in liquid dielectrics -Various processes of breakdown in solid dielectrics.

UNIT 3 GENERATION OF HIGH VOLTAGES AND CURRENTS

9 Hrs.

Generation of high DC voltages: Rectifier, Voltage doubler circuits, Cockroft Walton voltage multiplier circuit, Van de Graffe generator - Generation of high AC voltage: cascaded transformers, resonant transformers- Generation of high frequency a.c. high voltage - Generation of impulse voltages: Standard impulse waveshapes, Marx Circuit - generation of switching surges - generation of impulse current - tripping and control of impulse generators.

UNIT 4 MEASUREMENT OF HIGH VOLTAGES AND CURRENTS

9 Hrs.

High Resistance with series ammeter -Potential Divider - Generating Voltmeters - Capacitance Voltage Transformer, Electrostatic Voltmeters - Sphere Gaps - Hall generator - Resistive Shunts -Rogowski coils - Cathode Ray Oscillographs for impulse measurement.

UNIT 5 TESTING OF ELECTRICAL APPARATUS

9 Hrs.

Testing of Insulators and Bushings - Testing of Isolators and Circuit Breakers - Testing of Cables - Testing of Transformers - Testing of Surge arresters - Radio Interference Measurements - Standards and Specifications.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Select a suitable protection for over voltage in electrical power system
- CO2 - Justify the suitable dielectric for high voltage applications
- CO3 - Evaluate the performance of high DC,AC voltages and currents generators
- CO4 - Propose a suitable technique for measuring high voltages and currents
- CO5 - Comprehend the testing procedure for isolators, circuit breakers, bushing and transformer
- CO6 - Develop a procedure for testing high voltage devices by adhering to the standards

TEXT / REFERENCE BOOKS

1. M. S. Naidu and V. Kamaraju, 'High Voltage Engineering', 5th Edition Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2013.
2. E.Kuffel and M.Abdullah, "High Voltage Engineering" - Pergamon Press, Oxford, 1970.
3. C.L.WADHWA, "High Voltage Engineering" - New Age International (P) Ltd, Publishers, 2007.
4. E.Kuffel and W.s. Zaengal, "High Voltage Engineering Fundamentals", 2nd Edition, Butterworth Heinemann, 2000.
5. H.M.Ryam, "High voltage Engineering and testing", 2nd Edition, 2001, IEEE power and energy series 32.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEC1304	FUNDAMENTALS OF COMMUNICATION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the basic concepts of a communication system and acquire knowledge about amplitude modulation and demodulation methods.
- To study about the principles of Frequency Modulation and Phase modulation schemes along with its types.
- To provide an understanding about sampling, pulse modulation concepts, digital modulation techniques and multiplexing methods.
- To know about the working principles of Transmitters and Receivers.
- To enrich knowledge the about optical communication system, satellite communication and power line carrier communication.

UNIT 1 BASICS AND AMPLITUDE MODULATION

9 Hrs.

Electromagnetic Spectrum and communication applications-Elements of communication systems-baseband and pass band signals-need for modulation-amplitude modulation-modulation index of AM-frequency spectrum-AM power distribution in AM_DSB_FC- generation of AM_DSB_SC using FET balanced modulator-Generation of AM_SSB using phase shift and filter method-AM VSB-Comparison of AM schemes. - AM demodulation-Envelope detector-significance of RC time constant in envelope detector

UNIT 2 ANGLE MODULATION

9 Hrs.

Principle of angle modulation-Frequency modulation-modulation index of FM-frequency deviation-deviation ratio-Carson's rule for bandwidth of FM-Comparison of AM and FM-narrow band and wideband FM-comparison Generation of FM using varactor diode modulator (direct method)-Indirect method of FM generation. Phase modulation-Generation of PM using frequency modulator.FM demodulation-Principle of slope detection-balance slope detector-Foster Seely discriminator-ratio detector-amplitude limiting using ratio detector.

UNIT 3 PULSE MODULATION AND MULTIPLEXING

9 Hrs.

Pulse modulation-Sampling process-sampling theorem- concepts of PAM-PWM-PPM-Generation and demodulation of PAM, PWM, PPM-comparison-PCM system-quantization-DPCM-Adaptive Delta Modulation-Digital modulation techniques-ASK-FSK-PSK-QPSK. Concept of multiplexing-frequency division multiplexing-time division multiplexing-code division multiplexing-space division multiplexing

UNIT 4 TRANSMITTERS AND RECEIVERS

9 Hrs.

AM transmitter -low level modulator- high level collector and base modulator- FM transmitter-preemphasis concept- FM stereo broad cast transmitter. AM Receivers-super heterodyne receiver- AGC- choice of IF- tracking - alignment - receiver characteristics-FM receiver- Deemphasis concept-FM stereo broad cast receiver- AFC.

UNIT 5 BROAD BAND COMMUNICATION SYSTEM

9 Hrs.

Facsimile system - optical communication system-fiber optic cable modes -mobile telephone communication cellular concept- satellite communication system-satellite frequency plans and allocations-frequency reuse-satellite system link models- computer communication - electronic mail- power line carrier communication-SCADA.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyze the characteristics of various amplitude modulation schemes.
- CO2 - Analyze the characteristics of various frequency modulation schemes.
- CO3 - Determine the generation of pulse modulation and multiplexing techniques..
- CO4 - Analyze the transmitter and receiver circuits.
- CO5 - Examine the process of fiber optic and mobile telephone communications.
- CO6 - Determine the frequency allocation plans for satellite communication.

TEXT / REFERENCE BOOKS

- George Kennedy, "Electronic Communication Systems", Third Edition, TMH, New Delhi, 5th edition, 2011
- Anokh Singh, "Principles of Communication Engineering", S. Chand & Company Ltd, 2006
- Taub and Schilling, "Principles of Communication Systems", Third Edition, TMH, New Delhi, 2008.
- Louis Frenzel, "Communication Electronics", McGraw-Hill Companies, 4th edition, 2015.
- Bruce Carlson, "Communication Systems", McGraw Hill, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1601	FLEXIBLE AC TRANSMISSION SYSTEM	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To have a detailed knowledge in various reactive power compensators
- To understand the implementation of FACTS controllers in improvement of power system performance

UNIT 1 INTRODUCTION

9 Hrs.

Electrical Transmission Network – Emerging Transmission Network – Concept of Reactive Power – Load and System Compensation – Midpoint Voltage – Passive Compensation – Synchronous Condenser – Saturated Reactor – Classification of FACTS controllers.

UNIT 2 SHUNT COMPENSATION

9 Hrs.

Thyristor Controlled Reactor (TCR) – Thyristor Switched Reactor (TSR) – Thyristor Switched Capacitor (TSC) – Fixed Capacitor- Thyristor Controlled Reactor (FC-TCR) – Thyristor Switched Capacitor-Thyristor Controlled Reactor (TSC -TCR) – V-I Characteristics of Static Var Compensator (SVC) – Advantages of slope in dynamic Characteristic – Voltage control by SVC.

UNIT 3 THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC)

9 Hrs.

Fixed Series Compensation – Need for Variable Series Compensation – TCSC: Basic principle – Modes of Operation – Advantages – Capability Characteristic – Variable Reactance Model – Application: Open loop & Closed loop Control.

UNIT 4 EMERGING FACTS CONTROLLER

9 Hrs.

Static Synchronous Compensator (STATCOM): Introduction – Principle of Operation – V-I Characteristic. Multilevel VSC based STATCOM. SSSC: Principle of Operation. Unified Power Flow Controller (UPFC): Principle of Operation. Interline Power Flow Controller (IPFC): Principle of Operation.

UNIT 5 SUB SYNCHRONOUS RESONANCE (SSR)

9 Hrs.

Concept of SSR – NGH-SSR Damping scheme: basic concept – design and operation aspect. Thyristor Controlled Braking Resistor (TCBR), Advanced Series Capacitor (ASC): Basic concept – design and operation aspect

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyze the level of system and load compensation to balance reactive power.
- CO2 - Examine the performance of various Shunt Compensators
- CO3 - Inspect the effect of Thyristor Controlled Series Capacitor in open loop and closed loop applications
- CO4 - Identify Emerging FACTS controllers for various applications.
- CO5 - Evaluate the performance of SSR in Power System network.
- CO6 - Design the Advanced Series Capacitor for power control.

TEXT / REFERENCE BOOKS

1. R.Mohan Mathur and Rajiv K. Varma "Thyristor based FACTS controllers for electrical transmission systems", IEEE Press John Wiley & Sons Inc. Publication, 2002.
2. Narin G.Hingorani and Laszlo Gyugi "Understanding FACTS", IEEE Press Standard Publishers Distributors, 2001
3. K.R.Padiyar "FACTS controllers in power transmission and distribution", New Age International Publishers, 2009.
4. M.Noroozian et.al, " Use of UPFC for optimal power flow control"II Transactions on Power Delivery, Vol.12, No.4, oct 1997, pp 1629-1634
5. Gyugyi.L, —Unified Power Flow Control Concept for Flexible AC Transmission", IEEE Proc-C Vol.139, N0.4, July 1992
6. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age International (P) Ltd., New Delhi, 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1603	POWER SYSTEM OPERATION AND CONTROL	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand electric power system operation.
- To understand electric power system steady state control.
- To understand economic and technical feasible operating state.

UNIT 1 INTRODUCTION

9 Hrs.

System Load Variation: System Load Characteristics, Load curves - Daily, Weekly and Annual, Load Duration Curve, Load Factor, Diversity Factor, Reserve Requirements: Installed reserves, Spinning Reserves, Cold Reserves, and Hot Reserves. Overview of system operation: Load Forecasting, Unit Commitment, Load Dispatching. Overview of system control: Governor Control, LFC, EDC, AVR, System Voltage Control, Security control.

UNIT 2 COMMITMENT AND ECONOMIC LOAD DISPATCH

9 Hrs.

Statement of unit commitment (UC) problem-constraints in UC: Spinning Reserve, Thermal unit Constraints, Hydro Constraints, Fuel Constraints and other Constraints - UC solution methods: Priority -List Methods, Forward Dynamic Programming Approach, Lagrange Relaxation Method. Economic Load Dispatch: Incremental Cost Curves – Equal Incremental Cost Rule – Loss Coefficient – Coordination Equation.

UNIT 3 COMPUTER CONTROL OF POWER SYSTEMS

9 Hrs.

Energy control system: Function-monitoring, Data Acquisition and Control, System Hardware Configuration-Scada and Ems Function: Network Topology Determination, Steady State Estimate, Security Analysis and Control. Various operating states: normal, Alert, emergency: Extremely Emergency and Restorative- State Transition Diagram Showing Various State Transition and Control Strategies.

UNIT 4 ACTIVE POWER AND FREQUENCY CONTROL

9 Hrs.

Fundamentals of Speed Governing - Control of Generating Unit Power Output - Composite Regulating Characteristics of Power Systems - Response rates of Turbine Governing Systems - Fundamentals of automatic generation control - Implementation of AGC - Under Frequency Load Shedding.

UNIT 5 REACTIVE POWER AND VOLTAGE CONTROL

9 Hrs.

Production and Absorption of Reactive Power – Method Production and Absorption of Reactive Power - Methods of Voltage Control - shunt Reactors, Shunt Capacitors, Series Capacitors, Synchronous Condensers, Static var Systems-Principles of Transmission System Compensation – Modeling of Reactive Compensation Devices - Application of Tap-Changing Transformers to Transmission Systems - Distribution System Voltage Regulation - Modeling of Transformer ULTC Control System.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Interpret the day-to-day operation of electric power system.
- CO2 - Analyze the Unit Commitment and Economic Dispatch Problem
- CO3 - Design of SCADA for various applications in real time operation
- CO4 - Construct the Speed Governing Mechanism and explain Load Shedding
- CO5 - Categorize the various compensation device for voltage control
- CO6 - Examine the performance of Tap Changing Transformer

TEXT / REFERENCE BOOKS

1. P.Kundur, "Power system stability & control", Tata McGraw Hill publications, 5th reprint 2014.
2. Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheble, "Power generation, operation and control", John Wiley & sons, Inc, 3rd Edition, 2013.
3. Olle.I.Elgerd, "Electric Energy Systems theory" – An Introduction, Tata Mc Graw Hill Publishing Copmpany Ltd, NewDelhi, 2nd Edition, 2014.
4. D. P. Kothari and I. J. Nagrath, "Modern power system analysis", 4th Edition, Tata McGraw hill publishing company limited, NewDelhi, 2013.
5. Leonard L.Grigsby, "The Electric Power Engineering Handbook", CRC press press, 3rd edition 2012

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1607	RENEWABLE ELECTRIC SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the need and advantages of renewable energy.
- To study the performance efficiency and the relevancy to the future energy needs.

UNIT 1 INTRODUCTION

9 Hrs.

Classification of Energy Resources - Importance of Non- Conventional Energy Resources - Advantages and Disadvantages of Non-Conventional Energy Resources - Environmental Aspects of Energy - World Energy status - Energy scenario in India - Principles of Energy Conservation – Cogeneration.

UNIT 2 SOLAR ENERGY

9 Hrs.

Theory of solar cells - VI and PV curves - Equivalent circuit. Concept of solar PV module, Panel, Array, Maximum Power Point tracking - Solar PV systems - Solar PV Applications. Solar Thermal Systems-Solar Collector's Classifications- Flat plate collectors - Focus type collectors – Solar Refrigeration and Air-Conditioning System - Solar Pond Power Plant - Solar Thermal Power Plant

UNIT 3 WIND ENERGY

9 Hrs.

Wind Power and its Sources-Energy from Wind - Horizontal axis Wind Turbine - Vertical Axis Wind Turbine - Wind Energy Conversion Systems - Cp Vs Speed Curve.

UNIT 4 GEOTHERMAL, BIOMASS, TIDAL ENERGY

9 Hrs.

Geothermal Energy:-Resources of geothermal energy- environmental considerations. Bio-mass-Availability of bio-mass and its conversion technologies-Biogas production from Bio-mass. Tidal energy-tidal range power-ocean tidal energy conversion-Ocean Thermal Energy Conversion technology (OTEC)

UNIT 5 FUEL CELL AND MISCELLANEOUS NONCONVENTIONAL TECHNOLOGIES

9 Hrs.

Fuel Cells - Principle of Working - Classification of Fuel Cells - Construction, Working and Performance of Phosphoric Acid Fuel Cell and Alkaline Fuel Cell - VI Characteristics of Fuel Cell - Fuel Cell Power Plant - MHD Power Conversion-Thermo Electric Power Conversion - Thermionic Power Conversion.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Comprehend the different types of conventional energy resources.
- CO2 - Design a suitable solar energy conversion system for real world.
- CO3 - Design the suitable Wind Energy conversion system for real world application.
- CO4 - Design a smart grid for uninterrupted power supply from non conventional energy resources.
- CO5 - Justify, the suitability of fuel cells for addressing the energy problems of the modern world
- CO6 - Justify, the suitability of Thermo Electric and Thermionic Power Conversion system for addressing the energy problems of the modern world.

TEXT / REFERENCE BOOKS

1. B Khan, "Non conventional Energy resources", Tata McGrawHill, 2 nd Edition 2009.
2. Mukund R. Patel, "Wind & Solar Power Systems- Design, Analysis and Operation", Taylor and Francis, 2nd Edition 2005.
3. James Larminie & Andrew Dicks, "Fuel Cell Systems Explained", John Wiley & Sons, 2nd Edition.
4. John Twiddeu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEC1609	FUNDAMENTALS OF FUZZY LOGIC AND ARTIFICIAL NEURAL NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To comprehend the concepts of biological neuron and the learning algorithms
- To study the various methodologies to train the multi-hop network
- To acquire knowledge about SOM and special networks
- To study the basic principles of fuzzy logic and fuzzy operators
- To understand the concept of fuzzy logic controller and its applications

UNIT 1 FUNDAMENTALS OF ANN

9 Hrs.

Introduction - Biological Neuron structure, ANN - Definition – Topology - Models - Learning strategies. Characteristics of ANN - Different Learning Rules - Activation dynamics - Synaptic dynamics - **Perceptron Model** (Both Single & Multi-Layer) - Training Algorithm - Linear Separability Limitation and Its Over Comings, Problems in perceptron weight adjustments.

UNIT 2 MULTI LAYER NETWORKS

9 Hrs.

BPN - Training - Architecture-Algorithm, Counter Propagation Network - Training - Architecture, BAM - Training-stability analysis, Adaptive Resonance Theory - ART1- ART2 – Architecture -Training, Hop Field Network - Energy Function - Discrete - Continuous - Algorithm - Application - TSP .

UNIT 3 SOM & SPECIAL NETWORKS

9 Hrs.

SOM-Introduction - Kohonon SOM - Linear vector quantization, Probabilistic neural network ,Cascade correlation, General Regression neural network, Cognitron - **Application of ANN** - Texture classification - Character recognition.

UNIT 4 INTRODUCTION TO FUZZY LOGIC

9 Hrs.

Classical set - Operations and properties - Fuzzy Set - Operations and properties - Problems, Classical Relations - Operations and Properties, Fuzzy Relations - Operations and Properties - Compositions Membership function -FLCS - Need for FLC- Fuzzification - Defuzzification.

UNIT 5 FLCS, CLASSIFICATION & APPLICATIONS

9 Hrs.

Fuzzy decision making -Types, Fuzzy Rule Based System, Knowledge Based System, Non linear Fuzzy Control system - Fuzzy Classification - Hard C Means - Fuzzy C Means. **Applications of fuzzy - Water level controller, Fuzzy image Classification, Speed control of motor.**

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Comprehend various topologies of artificial neural networks.
- CO2 - Illustrate training and learning of neural systems using supervised and unsupervised methodologies
- CO3 - Develop multi-layer and special networks for different case studies
- CO4 - Appraise the behavior of Fuzzy logic control system
- CO5 - Evaluate the Defuzzification and fuzzy decision systems for real time applications.
- CO6 - Construct Fuzzy based controller for motor speed control, image processing etc

TEXT / REFERENCE BOOKS

1. Timothy Ross, "Fuzzy Logic with Engineering Application", McGraw Hill, Edition 1997
2. James A. Freeman & Skapura, "Neural Networks", Pearson Education, 2007.
3. B.Yegnanarayana, "Artificial Neural Networks" Prentice Hall, September 2007. 4. Simon Haykin, "Artificial Neural Networks", Second Edition, Pearson Education.
4. Drainkov, H.Hallendoor and M.Reinfrank, "An Introduction to Fuzzy Control", Edition 2001.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEC1618	PROGRAMMING IN MATLAB	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand basic representation of Matrices and vectors in MATLAB
- To learn various programming structures in MATLAB
- To study built in and user defined functions in MATLAB.
- To become conversant with 2D as well as 3D graphics in MATLAB
- To make a Graphical User Interface (GUI) in Matlab in order to achieve interactivity
- To Design simple Applications with Simulink (mdl files) and (M files) MATLAB.

UNIT 1 INTRODUCTION TO MATLAB

9 Hrs.

Menus & Tool bars, Variables - Matrices and Vectors - initializing vectors - Data types- Functions - User defined functions - passing arguments - writing data to a file-reading data from a file - using functions with vectors and matrices- cell arrays & structures - Strings - 2D strings-String comparing - Concatenation - Input and Output statements - Script files

UNIT 2 LOOPS AND CONTROL STATEMENTS

9 Hrs.

Introduction; Relational & Logical operations - Example programs - Operator precedence - Control & Decision statements- IF - IF ELSE - NESTED IF ELSE - SWITCH - TRY & CATCH - FOR -WHILE - NESTED FOR - FOR with IF statements, MATLAB program organization, Debugging methods - Error trapping using eval&lastern commands.

UNIT 3 PLOTS IN MATLAB AND GUI

9 Hrs.

Basic 2D plots, Labels, Line style, Markers, plot, subplot, LOG, LOG-LOG, SEMILOG-POLAR-COMET, Gridaxis, labeling, fplot, ezplot, ezpolar, polyval, exporting figures, HOLD, STEM, BAR, HIST, Interactive plotting, Basic Fitting Interface – Polyfit - 3D plots – Mesh - Contour - Example programs. GUI - Creation Fundamentals – Capturing mouse actions

UNIT 4 MISCELLANEOUS TOPICS

9 Hrs.

File & Directory management - Native Data Files - Data import & Export - Low Level File I/O – Directory management - FTP File Operations - Time Computations -Date & Time - Format Conversions - Date & Time Functions- Plot labels - Optimization - zero Finding - Minimization in one Dimension - Minimization in Higher Dimensions- Practical Issues. Differentiation & Integration using MATLAB, 1 D & 2D Data Interpolation

UNIT 5 SIMULINK AND APPLICATIONS

9 Hrs.

How to create & run Simulink, Simulink Designing - Using SIMULINK Generating an AM signal & 2n d ordersystems - Designing of FWR & HWR using Simulink - Creating a subsystem in Simulink. Applications Programs -Frequency response of FIR & IIR filters. Open Loop gain of OPAMP, I/P characteristics of BJT, Plotting the graph between Breakdown voltage & Doping Concentration. PCM, DPCM

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Comprehend matrices, vectors and strings in MATLAB, operations in files
- CO2 - Develop MATLAB programs using looping and control statements
- CO3 - Develop 2D and 3D plots, Graphical User Interface for a given problem
- CO4 - Develop file management system using MATLAB
- CO5 - Design Simulink for electronic circuits and communication systems
- CO6 - Develop MATLAB programming for real time applications

TEXT / REFERENCE BOOKS

1. RudraPratap, "Getting Started with MATLAB 6.0", 1st Edition, Oxford University Press-2004.
2. Duane Hanselman, Bruce LittleField, "Mastering MATLAB 7", Pearson Education Inc, 2005
3. William J.Palm, "Introduction to MATLAB 6.0 for Engineers", McGraw Hill & Co, 2001
4. M.Herniter, "Programming in MATLAB", Thomson Learning, 2001
5. John OkyereAlita, "Electronics and circuit analysis using MATLAB" - CRC press, 1999
6. K.K.Sharma, "MATLAB Demustified" -Vikas Publishing House Pvt Ltd.
7. K.C.Ravindaranath, "Systems Modelling& Simulation"

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SIC1310	THEORY OF ROBOTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce basic concepts of various dynamics processes
- To educate on the effect of various power sources and sensors.
- To impart knowledge on the manipulators, grippers and robot dynamics
- To introduce the evaluation criteria and tuning techniques of controllers
- To introduce the concept of multi loop control techniques.

UNIT 1 BASIC CONCEPTS

9 Hrs.

Origin & various generation of Robots - Robot definition - Robotics system components - Robot classification Coordinate frames - Asimov's laws of robotics - degree of freedom - dynamic stabilization of robots.- work volume. Need for Automation - types of automation - fixed, programmable and flexible automation

UNIT 2 POWER SOURCES AND SENSORS

9 Hrs.

Hydraulic, pneumatic and electric drives - determination of HP of motor and gearing ratio - variable speed arrangements - path determination - micro machines in robotics - machine vision - ranging - laser - acoustic - magnetic, fiber optic and tactile sensors.

UNIT 3 MANIPULATORS, ACTUATORS, GRIPPERS and ROBOT DYNAMICS

9 Hrs.

Construction of manipulators - manipulator dynamics and force control -pneumatic electronic and manipulator control circuits - end effectors - various types of grippers- design considerations. Introduction to Robot Dynamics - Lagrange formulation - Newton Euler formulation - Properties of robot dynamic equations.

UNIT 4 KINEMATICS AND PATH PLANNING

9 Hrs.

Forward Kinematics - Denavit Hartenberg Representation. multiple solution jacobian work envelop, Inverse Kinematics - Geometric approach. Hill climbing techniques.

UNIT 5 PROGRAMMING LANGUAGES AND APPLICATIONS

9 Hrs.

Robot programming - Fixed instruction, sequence control, General programming language, programming languages. Robots for welding, painting and assembly - Remote Controlled robots - robots in manufacturing and non- manufacturing applications - Robots for nuclear and chemical plants.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Identify the types of robots and its coordinates
- CO2 - Describe power sources and sensors used in robots
- CO3 - Apply the Newton Euler formulation in deriving dynamics of robots.
- CO4 - Analyze forward and inverse kinematics of robots.
- CO5 - Build robot programming for various applications
- CO6 - Design a robot for any application

TEXT / REFERENCE BOOKS

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", McGraw-Hill Singapore, 1996.
2. Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai, 1998.
3. Deb.S.R., "Robotics technology and flexible Automation", John Wiley, USA 1992.
4. Asfahl C.R., "Robots and Manufacturing Automation", John Wiley, USA 1992.
5. Klawter R.D., Chmielewski T.A., Negin M., "Robotic Engineering - An integrated approach", Prentice Hall of India, New Delhi, 1994.
6. Mc Kerrow P.J. "Introduction to Robotics", Addison Wesley, USA, 1991.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1610	ADVANCED POWER ELECTRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge on different types of power semiconductor devices and its switching characteristics.
- To study the operation, characteristics and performance parameters of controlled rectifiers.
- To understand the operations of choppers and inverters.
- To get acquainted with the applications of power electronics converters.

UNIT1 SWITCHING VOLTAGE REGULATORS

9 Hrs.

Introduction - Linear power supply (Voltage regulators) - Switching voltage regulators - Review of basic DC-DC voltage regulator configurations - Buck, Boost, Buck-Boost converters and their analysis for continuous and discontinuous mode - Other converter configurations like Flyback converter, Forward converter, Half bridge, Full bridge configurations, Push-pull converter, Cuk converter, Sepic Converter - Design criteria for SMPS - Multi-output switch mode regulator.

UNIT 2 RESONANT CONVERTERS

9 Hrs.

Introduction - Need of resonant converters - Classification of resonant converters - Load resonant converters - Resonant switch converters - Zero-voltage switching DC-DC converters - Zero current switching DC-DC converters - Clamped voltage topologies.

UNIT 3 MULTI-LEVEL CONVERTERS

9 Hrs.

Need for Multi-level inverters - Concept of multi-level - Topologies for multi-level - Diode Clamped, Flying capacitor and Cascaded H-bridge multilevel Converters configurations - Features and relative comparison of these configurations applications - Introduction to carrier based PWM technique for multi-level converters.

UNIT4 MULTI-PULSE CONVERTERS

9 Hrs.

Concept of multi-pulse - Configurations for m-pulse ($m=12,18,24, \dots$) converters - Different phase shifting transformer (Y- $\Delta 1$, Y- $\Delta 2$, Y-Z1 and Y-Z2) configurations for multi-pulse converters - Applications

UNIT 5 HVDC TRANSMISSION

9 Hrs.

Introduction - Operation of 12-pulse converter as receiving and sending terminals of HVDC system - Equipment required for HVDC System and their significance - Comparison of AC and DC transmission - Control of HVDC transmission

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 – Understand the Characteristics of various Switching Voltage Regulators.
- CO2 - Evaluate the various performances of Resonant Converters.
- CO3 - Analyze different multi-level converter Circuits.
- CO4 - Design various Multi-pulse Converters based on real time applications.
- CO5 - Apply and analyze the HVDC Transmission applications.
- CO6 - Implement advanced Power Electronic Converters to meet industrial requirements.

TEXT / REFERENCE BOOKS

- 1.Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics – Converters, Applications and Design", John Wiley & sons, Inc., 4th ed., 2007.
- 2.Muhammad H. Rashid, "Power Electronics - Circuits, Devices and Applications", Prentice Hall of India, 4th ed., 2014.
- 3.Bin Wu, "High Power Converters and AC Drives", John Wiley & sons, Inc., 2006.
- 4.Derek A. Paice "Power Electronic Converter Harmonics – Multi-pulse Methods for Clean Power", IEEE Press, 1999.
- 5.Muhammad H. Rashid, "Power Electronics Handbook", Elsevier, 4th ed., 2021.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1611	ELECTRIC VEHICLE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concept of conventional vehicle
- To acquire the knowledge about the electric vehicle
- Apply the control of control techniques for motors
- To understand the transmission system used in electric vehicle
- To acquire the knowledge about the battery charging system

UNIT 1 VEHICLE FUNDAMENTALS

9 Hrs.

General Description of Vehicle Movement, Vehicle Resistance, Dynamic Equation, Tire–Ground Adhesion and Maximum Tractive Effort, Power Train Tractive Effort and Vehicle Speed-Vehicle Power Plant and Transmission Characteristics-Vehicle Performance-Braking Performance-Performance of Electric Vehicles.

UNIT 2 ELECTRIC VEHICLE FUNDAMENTALS

8 Hrs.

EV Types, EV Configurations, Energy Sources, Motors Used, Charging Systems, Power Conversion Techniques, Technological Problems, Control Algorithms, Trends and Future Developments

UNIT 3 ELECTRIC TRAIN

9 Hrs.

Series Hybrid Electric Drive Train Design-Sizing of the Major Components- The Hybrid Electric Vehicle-Energy Use in Conventional Vehicles-Energy Savings Potential of Hybrid Drive trains-HEV Configurations-Series Hybrid System-Parallel Hybrid System-Series-Parallel System-Complex Hybrid System.

UNIT 4 DC CHOPPERS AND INDUCTION MOTOR DRIVES

10 Hrs.

DC motor drive-Chopper control of DC motor drive- multi-quadrant control of Chopper fed drive Induction motor drive-constant v/f control-power electronics control-FOC-VSI for FOC.

UNIT 5 ELECTRIC PROPULSION SYSTEM

9 Hrs.

PMBLDC motor drive-basic principle – construction-classification-performance and control of PMBLDC machine. SRM drive-basic magnetic structure-SRM drive converter-modes of operation-generating modes of operation.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply Vehicle concept to electric vehicle
- CO2 - Analyze the power conversion technique of electric vehicle
- CO3 - Examine the performance of different electric drive train
- CO4 - Select the appropriate electric motor for electric propulsion system
- CO5 - Select a suitable battery for electric vehicle
- CO6 - Analyze the recent technique used in modern electric vehicle

TEXT / REFERENCE BOOKS

- 1.M. Ehsani, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2005 Suggested Reading.
- 2.Tom Denton, Electric and Hybrid vehicle routledge,2016.
- 3.Husain, Electric and Hybrid Electric Vehicles, CRC Press, 2003
4. Un-Noor, F., Padmanaban, S., Mihet-Popa, L., Mollah, M.N. and Hossain, E., 2017. A comprehensive study of key electric vehicle (EV) components, technologies, challenges, impacts, and future direction of development. Energies, 10(8), p.1217.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1612	ELECTRICAL POWER QUALITY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge on sources and characteristics of power quality.
- To study the measurement and analysis of power quality indices.
- To understand the various power quality improvement techniques.
- To get acquainted with the high power applications.

UNIT I CHARACTERISATION OF ELECTRIC POWER QUALITY

9Hrs.

Introduction – Characterisation of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – General power quality problems: poor load power factor, Nonlinear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage.

UNIT II SOURCE OF POWER QUALITY PROBLEMS

9 Hrs.

Static power converter-DC/AC pulse width modulated drives-Switched mode power supplies-AC voltage regulators-Cycloconverter-Arc furnaces-Static VAR compensator-Inverters for Dispersed generation-Electronic phase control.

UNIT III MEASUREMENT OF POWER QUALITY INDICES

9 Hrs.

Measurement-General, Basic Equipment used for the analysis of non-sinusoidal voltages and currents, requirements of instrument response, Presentation of harmonic data, Transducers for harmonic measurements, Distortion factor, Crest factor.

UNIT IV ANALYSIS OF POWER QUALITY INDICES

9 Hrs.

Analysis methods-Harmonic current calculation, System frequency response calculations, Modelling Guide lines for Harmonic Analysis, Telephonic Interference, Line notching Calculations, Total Harmonic distortion, Displacement power factor improvement calculation.

UNIT V POWER QUALITY IMPROVEMENT TECHNIQUES

9 Hrs.

Power factor corrector-Harmonic filter-passive, Active and Hybrid filters –Static compensator-Distribution static compensator-Dynamic voltage restorer- Protecting sensitive loads using DVR - Use of PWM techniques in power quality improvement.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the characterization of electric power quality.
- CO2 - Evaluate the various source of power quality problems.
- CO3 - Analyze different types of power quality indices.
- CO4 - Design various methods for power quality measurements.
- CO5 - Apply and analyze the various power quality improvement techniques.
- CO6 - Implement power quality methods in high power applications.

REFERENCES

- 1.Arindam Ghosh "Power Quality Enhancement Using Custom Power Devices", Kluwer Academics Publishers, 2002
- 2.G.T Heydt, "Electric Power Quality", Stars in Circle Publications, 1994, (2nd Edition).
3. J.Arilliga, N.R.Watson and S.Chen, "Power System QualityAssessment", John wiley& Sons,England, 2000.
- 4.Robert W. Erickson &Dragon Maksimovic, "FundamentalsofPowerelectronics" second edition, 2001 spring and Business media.
- 5.IEEE Recommended practices and requirements for Harmonic control in Electrical power systems, IEEE Std. 519-1992.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1613	ENERGY STORAGE SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To develop the ability to understand / analyze the various types of energy storage.
- To study the various applications of energy storage systems.
- To analyze various types of energy storage devices and perform the selection based on techno-economic view point.

UNIT 1 INTRODUCTION

8 Hrs.

Necessity of energy storage – types of energy storage – comparison of energy storage technologies – Applications.

UNIT 2 ELECTRICAL ENERGY STORAGE

10 Hrs.

Fundamental concept of batteries – measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel – Cadmium, Zinc Manganese dioxide and modern batteries for example zinc-Air, Nickel Hydride, Lithium Battery.

UNIT 3 FUEL CELL

9 Hrs.

Fuel Cell – History of Fuel cell, Principles of Electrochemical storage – Types – Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis – advantage and drawback of each type.

UNIT 4 THERMAL STORAGE SYSTEM

9 Hrs.

Thermal storage – Types – Modelling of thermal storage units – Simple water and rock bed storage system – pressurized water storage system – Modelling of phase change storage system – Simple units, packed bed storage units - Modelling using porous medium approach, Use of Transys

UNIT 5 ALTERNATE ENERGY STORAGE TECHNOLOGIES

9 Hrs.

Flywheel, Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the different energy storage technology
- CO2 - Analyze the technical aspects of battery storage system
- CO3 - Examine the performance of fuel cell storage system
- CO4 - Evaluate the performance of different thermal storage system
- CO5 - Criticize the different alternate energy storage technology
- CO6 - Select suitable alternate energy storage technology for real world application

TEXT / REFERENCE BOOKS

1. Ibrahim Dincer and Mark A. Rosen, "Thermal Energy Storage Systems and Applications", John Wiley & Sons 2002.
2. James Larminie and Andrew Dicks, "Fuel cell systems Explained", Wiley publications, 2003.
3. Lunardini.V.J, Heat Transfer in Cold Climates, John Wiley and Sons 1981..
4. Ru-shiliu, Leizhang and Xueliang sun, "Electrochemical technologies for energy storage and conversion", Wiley publications, 2012.
5. Schmidt.F.W and Willmott.A.J, Thermal Storage and Regeneration, Hemisphere Publishing Corporation, 1981.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEE1614	INDUSTRIAL INSTRUMENTATION AND AUTOMATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To study the various Components in the Industrial Automation.
- To have an adequate knowledge about different industrial instrumentation
- To get the Knowledge in PLC for various Applications
- To Study the various components in SCADA.

UNIT 1 INTRODUCTION

9 Hrs.

Need and benefits of Industrial Automation, Automation Hierarchy, Basic components of automation system, description of each component, Types of automation system: - Fixed, programmable, flexible.

UNIT 2 SENSORS AND TRANSDUCER

9 Hrs.

Piezoelectric, Photovoltaic, Hall Effect, Magneto strictive, Radio-Active Absorption, Ionic Conduction Transducers, Digital Transducers - Digital Displacement Transducer, Shaft Angle Encoder, Optical Encoders, Magnetic Encoders -Digital Speed Transducers -Variable Reluctance Type, Smart Sensors - SQUID Sensors - Film Sensors – MEMS - Basic Concept of MEMS

UNIT 3 INTRODUCTION TO PLC

9 Hrs.

Introduction to Sequence Control, PLCs - Working, Specifications of PLC Onboard/Inline/Remote IO's, Comparison of PLC & PC, Relay Ladder Logic- PLC Programming- realization of AND, OR logic, concept of latching.

UNIT 4 PLC AND ITS APPLICATIONS

9 Hrs.

Introduction to Timer/Counters, ON Delay Timer, OFF Delay Timer - Exercises based on Timers, Counters - Up Counters, Down Counters. Logical Instructions, Comparison Instruction, Arithmetic Instructions, Data Handling Instructions. PLC based applications: Motor sequence control, Traffic light control, elevator control, Tank level control, conveyor system, Stepper motor control.

UNIT 5 SCADA

9 Hrs.

Introduction to SCADA, typical SCADA block diagram, - Common System Components Supervision and Control- HMI, RTU and Supervisory Stations- Trends in SCADA, benefits of SCADA. Interfacing SCADA system with PLC: Typical connection diagram, Object linking and embedding for Process Control (OPC) architecture.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Identify Different components of an Automation System.
- CO2 - Analyze the New sensors and Transducer for the applications
- CO3 - Interface the given I/O Device with appropriate PLC Module.
- CO4 - Prepare a PLC Ladder Program for the given applications.
- CO5 - Prepare a simple SCADA Applications.
- CO6 - Design the Interfacing SCADA system with PLC

TEXT / REFERENCE BOOKS

1. Stenerson, Jon," Industrial Automation and Process Control", PHI Learning, New Delhi, ISBN 9780130618900.
2. D. Patra Nabis, 'Sensors and Transducers', Prentice Hall of India, 1999.
3. Dr. S. Renganathan, "Transducer Engineering" -Allied Publishers Limited.
4. Jadhav, V. R.," Programmable Logic Controller", Khanna publishers, New Delhi, 2017, ISBN : 9788174092281
5. Petruzella,F.D," Programmable Logic Controller", Tata — McGraw Hill India, New Delhi, Fourth edition,2010, ISBN: 9780071067386.
6. Mitra, Madhu Chandra, Sengupta, Samarjit," Programmable Logic Controllers and Industrial Automation an Introduction", Penram International Publication, New Delhi 2015,Fifth Reprint, ISBN 9788187972174.
7. Boyar,S.A," Supervisory Control and Data Acquisition", ISA Publication, New Delhi , Fourth Edition, ISBN 978-1936007097.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1615	TESTING AND COMMISSIONING OF ELECTRICAL EQUIPMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To undertake installation, commissioning and maintenance of various electrical equipment.
- To impart knowledge on maintenance schedule of different equipment and machines.
- To trouble shoot various electrical equipment, machines and domestic appliances.
- To have familiar about electrical safety regulations and rules during maintenance.

UNIT 1 SAFETY MANAGEMENT

9Hrs.

Objectives, Safety Management during Operation and Maintenance, Clearance and Creepages, Electric Shock, need of Earthing, different methods of Earthing, factors affecting the Earth Resistance, methods of measuring the Earth Resistance, Equipment Earthing and System Grounding, Earthing Procedure - Building installation, Domestic appliances, Industrial premises, Earthing of substation, generating station and overhead line.

UNIT 2 TESTING OF TRANSFORMER, PLANT AND EQUIPMENT:

9 Hrs.

Measurement of winding resistance, voltage ratio and check of voltage vector relationship; Measurement of impedance voltage/short-circuit impedance and load loss; Measurement of no-load loss and current; Measurement of insulation resistance; Dielectric tests; Temperature-rise, insulation and HV test, dielectric absorption, switching impulse test. Drying out procedure for transformer. PI index, Commissioning steps for transformer, Troubleshooting & Maintenance of transformer.

UNIT 3 INSTALLATION AND COMMISSIONING OF ROTATING ELECTRICAL MACHINES

9 Hrs.

Degree of protection, cooling system, degree of cooling with IP- IC code (brief discussion), enclosures, rating of industrial rotating electric machine, installation, commissioning and protection of rotating electric machine, drying out of electric rotating machine, insulation resistance measurement, site testing and checking, care, services and maintenance of motors.

UNIT 4 TRANSMISSION LINE

9 Hrs.

Commissioning of A.C transmission line and HVDC transmission, galvanize steel structure, towers and insulator for transmission and distribution line, tower footing resistance, substation equipment, bus bar system, power cable, low power control cable, Contactor, GIS (gas insulated substation).

UNIT 5 SWITCH GEAR & PROTECTIVE DEVICES

9 Hrs.

Standards, Classification, specification, rating and duties of CB, installation, commissioning tests, maintenance schedule, type & routine tests. Operation of s/s (steps) for line Circuit breaker maintenance. Location of lightening arrester with reasons.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the Procedure of different types of earthing for different types of electrical installations.
- CO2 - Trouble shoot and preparing the maintenance schedule of the transformers.
- CO3 - Analyze and trouble shoot various types of rotating electrical machines.
- CO4 – Estimate the commissioning of AC transmission line and HVDC transmission.
- CO5 – Prepare the maintenance schedule for switch gear and protective devices.
- CO6 – Plan the location of lightening arrester.

REFERENCES

1. Rao, S., "Testing, commissioning, operation and maintenance of electrical equipment", 6/E., Khanna Publishers, New Delhi
2. Paul Gill, "Electrical power equipment maintenance and testing", CRC Press, 2008.
3. Singh Tarlok, "Installation, commissioning and maintenance of Electrical equipment", S.K. Kataria and Sons, New Delhi,
4. Philip Kiameh, "Electrical Equipment Handbook: Troubleshooting and Maintenance", McGrawHill, 2003.
5. Relevant Indian Standards (IS Code) and IEEE Standards for-Installation, maintenance and commissioning of electrical equipments/machines.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SEE1616	EMBEDDED SYSTEMS AND IoT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand fundamentals of IoT and embedded system including essence, basic design strategy and process modeling.
- To develop comprehensive approach towards building small low cost embedded IoT system.
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies

UNIT 1 INTRODUCTION TO EMBEDDED SYSTEM AND IOT

9 Hrs.

Introduction to embedded systems, Application Areas ,Categories of embedded systems, Overview of embedded system architecture, Specialties of embedded systems, recent trends in embedded systems, Introduction to ARM processor and its architecture. Internet Of Things Promises–Definition– Scope–Sensors, IoT Applications–Structure of IoT– IoT Map Device ; IoT Sensors-Characteristics-types. IoT Issues and Challenges, Applications.

UNIT 2 EMBEDDED IoT PLATFORM DESIGN METHODOLOGY

9 Hrs.

Purpose and requirement specification, Process specification, Domain model specification, information model specification, Service specifications, IoT level specification, Functional view specification, Operational view specification, Device and component integration, Application development.

UNIT 3 PILLARS OF EMBEDDED IoT AND PHYSICAL DEVICES

9 Hrs.

The internet of devices, The internet of objects, The internet of transducer, o The internet of controllers, Device to Connect and Manage, talk, Connect. Network, Basic building blocks of and IoT device, Exemplary device: Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, ■ Beagle board and other IoT Devices.

UNIT 4 WEB OF THINGS AND CLOUD OF THINGS

9 Hrs.

Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud Standards – Cloud Providers and Systems, Mobile Cloud Computing, The Cloud of Things Architecture.

UNIT 5 IoT CLOUD OFFERINGS AND IoT CASE STUDIES

9 Hrs.

Introduction to Cloud Storage Models, Communication API, Amazon Web Services for IoT, Skynet IoT Messaging Platform. Case Studies: Home Intrusion Detection, Weather Monitoring System, Air Pollution Monitoring, Smart Irrigation, Energy Harvesting.

Max. 45 Hrs.

COURSE OUTCOMES

- On completion of the course, student will be able to
- CO1 - Understand the basic concepts of embedded systems and IoT.
 - CO2 - Apply the design methodology for embedded IoT Platform.
 - CO3 - Develop programs using Python for Raspberry Pi.
 - CO4 - Comprehend web of things and cloud of things.
 - CO5 - Implement IoT Cloud Offerings for
 - CO6 - Solve the given societal challenge using IoT

TEXT / REFERENCE BOOKS

- 1.Adrian McEwen and Hakim Cassimally, —Designing the Internet of ThingsII, John Wiley and Sons Ltd, UK, 2014.
- 2.Vijay Madiseti, Arshdeep Bahga, —Internet of Things (A Hands-on Approach), Universities Press, 2015.
- 3.Dieter Uckelmann, Mark Harrison, Florian Michahelles, —Architecting the Internet of ThingsII, Springer, New York, 2011.
- 4.John H. Davies, —MSP430 Microcontroller BasicsII, First Edition, Newnes Publication. 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SIC1608	POWER PLANT INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To Familiarize about different power generation process, various measurements & analysis in power plants, types of controls and control loops in boilers
- To provide in-depth understanding of nuclear power plant.

UNIT 1 INTRODUCTION

9 Hrs.

Brief survey methods of power generation - hydro, thermal, nuclear, solar and wind power - Importance of instrumentation in power generation - Piping and instrumentation diagram of a thermal power plant - Boiler types - water tube - fire tube - fluidized bed - Fuels - coal, fuel oil, natural and petroleum gas, synthetic fuels and biomass - Combustion process - Combustion of solid fuel, Combustion of fuel oil, combustion of gas - Cogeneration

UNIT 2 MEASUREMENTS IN POWER PLANTS

9 Hrs.

Metal temperature measurement in boilers, piping system for pressure measuring devices, Flow of feed water - fuel, air and steam with correction factor for temperature and pressure - smoke and dust monitor, flame monitoring. Drum level measurement - Radiation detector - Introduction to turbine supervising system - pedestal vibration - shaft vibration - eccentricity measurement. Installation of non-contracting transducers for speed measurement - rotor and casing movement and expansion measurement

UNIT 3 CONTROL LOOPS IN BOILER

9 Hrs.

Combustion Control -air/fuel ratio control - furnace draft control - drum level control- main stream and reheat steam temp control - super heater control - attemperator - de-aerator control - distributed control system in power plants - interlocks in boiler operation- Problems associated with control of multiple pulverizers - Fan drives and control

UNIT 4 ANALYZERS IN POWER PLANTS

9 Hrs.

Coal analyzer- thermo-gravimetry - gross calorific value - total sulphur analysis - ash analyzer - online monitor - air quality monitoring - Sampling of ambient air - general air sampling system - Flue gas oxygen analyzer - analysis of impurities in feed water and steam - dissolved oxygen analyzer - chromatography - pH Meter - pollution monitoring instruments

UNIT 5 NUCLEAR POWER PLANT INSTRUMENTATION

9 Hrs.

Introduction - Energy from nuclear reaction - Nuclear fission and fusion - Neutron flux and reaction rate - Types of reactor - pressurized water reactor - boiling water reactor - Nuclear waste disposal - Piping and instrumentation diagram of different types of nuclear power plant - Nuclear reactor control loops - reactor dynamics - excess reactivity - pulse channel and logarithmic instrumentation - control and safety instrumentation - reliability aspects

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Interpret the methods of power generation.
- CO2 - Analyze the measurement of various parameters in a power plant
- CO3 - Design the appropriate control techniques for boilers
- CO4 - Construct the oxygen analyzer of impurities in feed water and steam in power plant
- CO5 - Categorize the various reactors in nuclear power plants
- CO6 - Examine the control and safety instrumentation in nuclear power plant.

TEXT / REFERENCE BOOKS

1. Gill A.B, "Power Plant Performance", 6th Edition, Butterworth, London, 1984
2. Liptak. B.G, Analytical Instrumentation, Vol 1 & Vol 2, Chilton Book Company, 1994
3. Nag P.K "Power Plant Engineering", 2nd Edition, Tata McGraw Hill, 2001
4. Sam Dukelow. G "The control of Boilers", 2nd Edition, Instrument society of America, 1991
5. Elonka S.M, Kohan A.L, "Standard Boilers Operations", McGraw Hill, New Delhi, 1994
6. Wakil. E.A Power Plant Engineering, Tata McGraw Hill, 1984,
7. David Lindsley, "Boiler Control Systems", McGraw Hill, New York, 1991
8. Jain. R.K, "Mechanical and industrial Measurements", Khanna Publishers, New Delhi, 1995

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SIC1611	FUNDAMENTALS OF MECHATRONICS (For EIE, E&C and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION**9 Hrs.**

Mechatronics: Definition & Key Issues - Evolution - Elements - Mechatronics Approach to Modern Engineering, Industrial design and safety Design.

UNIT 2 SENSORS AND TRANSDUCERS**9 Hrs.**

Introduction and background, difference between transducer and sensor, transducers types, transduction principle, photoelectric transducers- thermistors, thermodevices, thermocouple, inductive transducers capacitive transducers, piezoelectric transducers, piezoelectric transducers. Hall Effect transducers, Fiber optic transducers, Signal Processing - Data Display.

UNIT 3 ACTUATION SYSTEMS**9 Hrs.**

Introduction to Mechanical Types and Electrical Types - Pneumatic & Hydraulic Systems - Applications - Selection of Actuators, Kinematics of robot manipulator links.

UNIT 4 DIGITAL AND CONTROL SYSTEMS**9 Hrs.**

Digital logic neuron system, Types of Controllers - Programmable Logic Controllers - applications - ladder diagrams - Microprocessor Applications in Mechatronics: Temperature measurement system, Domestic washing machine - Programming Interfacing - Computer Applications: CNC drilling machine

UNIT 5 RECENT ADVANCES**9 Hrs.**

Manufacturing Mechatronics - Automobile Mechatronics - Medical Mechatronics - Office Automation - Case Studies

Max. 45 Hours

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1	Illustrate the approach of Mechatronics to engineering concepts
CO2	Classify the different types of sensors, transducers.
CO3	Select an actuator and use of robot kinematics.
CO4	Apply the different control techniques for a process.
CO5	Comprehend the applications of mechatronics in the fields of automobile, robotics, medicine, manufacturing, office automation through case studies.
CO6	Apply the knowledge of mechatronics in various industries

TEXT / REFERENCE BOOKS

1. Bolton. W “Mechatronics: Electronic Control System for Mechanical & Electrical Engineering”, 2nd Edition Pearson Education, 2004.
2. Ramachandran. K.P, Vijaya Raghavan. G.K, Mechatronics, A.R.S. Publications, Second Edition, 2008.
3. Bradly.D.A, Dawson.D, Burd. N.C, Loader. A.J “Mechatronics: Electronics in Products and Processes” Nelson Publisher, 2004.
4. Michael B. Histan & David G. Alciators, “Introduction to Mechatronics & Measurement systems”, McGraw-Hill International Editions, 1998
5. Dan Neculescu, “Mechatronics”, Pearson Education, 2005. Bishop, Robert H, "Mechatronics Hand book", CRC Press, 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration :3Hrs.**

PART A : 10 Questions of 2 marks each-No choice

20 Marks

PART B : 2 Questions from each unit of internal choice, each carrying 16 marks

80 Marks

SCS1619	PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1**9 Hrs.**

Introduction to the IDLE interpreter (shell) -Expressions – Data Types - Built-in function -Conditional statements - Iterative statements- Input/output -Compound Data Types - Nested compound statements – Introduction to Object Oriented Concepts.

UNIT 2**9 Hrs.**

File Operations –Iterators - Exception handling - Regular Expressions

UNIT 3**9 Hrs.**

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colours - Canvas - Widgets (frame, label, button, check box, entry, list box, message, radio button, text, spin box).

UNIT 4**9 Hrs.**

Database (using NoSQL): Connector Module –Cursor – Statements - Exceptions in database.
Network connectivity: Socket module - Client – Server – Email – URL Access

UNIT 5**9 Hrs.**

Web Programming using Python.
Image Processing – Facebook Analysis – Twitter Analysis.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to:

- CO1 : To learn and demonstrate the decision controls, looping constructs, lists and dictionaries in the design of Python Program.
- CO2 : To design and develop GUI based applications.
- CO3 : To deploy Web based applications by integrating with NoSQL Database.
- CO4 : To analyze the contents social media on Text mining, Sentiment Analysis.
- CO5 : To implement Machine Learning Algorithms (Cluster Algorithms, Decision Trees) using libraries.
- CO6 : To demonstrate visualization using open source data sets.

TEXT / REFERENCE BOOKS

1. John Scott, "Social Network Analysis", Third Edition, SAGE Publications Ltd 2013.
2. Maksim Tsvetovat, Alexander Kouznetsov, "Social Network Analysis for Startups", First Edition, O'Reilly Media, 2011.
3. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
4. David Knoke, Song Yang, "Social Network Analysis", First Edition, SAGE Publication Ltd 2007.
5. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.
6. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking - Techniques and applications", First Edition Springer, 2011.
7. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009
Van.C.Warington, "Protective Relays-their Theory and Practice", Vol I & II, Champ Man and Hall Ltd, London, 2014.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration: 3 Hrs.****PART A:** 2 Questions from each unit, each carrying 2 marks

20 Marks

PARTB: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEE1617	COMPUTER AIDED ELECTRICAL DRAWING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To discuss the basic terminology of DC and AC armature windings.
- To discuss design and procedure to draw armature winding diagrams for Transformers, DC and AC machines
- To explain development of sectional views of Transformers, DC machine and alternators using the design data

UNIT 1 WINDING DIAGRAMS

9 Hrs.

Winding Diagrams of D.C. Machines: Simplex Double Layer Lap and Wave Windings. Winding Diagrams of AC .Machines. Integral and Fractional Slot Double Layer Three Phase Lap and Wave Windings. Single Layer Windings – Un-Bifurcated 2 and 3 Tier Windings, Mush Windings, Bifurcated 3 Tier Windings.

UNIT 2 SINGLE LINE DIAGRAMS

9 Hrs.

Single Line Diagrams of Generating Stations and Substations Covering Incoming Circuits, Outgoing Circuits, Busbar Arrangements (Single, Sectionalized Single, Main and Transfer, Double Bus Double Breaker, Sectionalised Double Bus, One and a Half Circuit Breaker Arrangement, Ring Main), Power Transformers, Circuit Breakers, Isolators, Earthing Switches, Instrument Transformers, Surge or Lightning Arresters, Communication Devices (Power-Line Carrier) and Line Trap.

UNIT 3 TRANSFORMERS ASSEMBLY DRAWINGS

9 Hrs.

Transformers - Sectional Views of Single and Three Phase Core And Shell Type Transformers

UNIT 4 D.C. MACHINE ASSEMBLY DRAWINGS

9 Hrs.

D.C. Machine - Sectional Views of Yoke with Poles, Armature and Commutator dealt separately.

UNIT 5 ALTERNATOR ASSEMBLY DRAWINGS

9 Hrs.

Alternator – sectional views of stator and rotor dealt separately battery storage and charging

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the basic concepts of DC and AC armature windings.
- CO2 - Develop a layout for substation using the standard symbols for substation.
- CO3 - Draw sectional views of core and shell types transformers using the design data.
- CO4 - Draw sectional views of assembled DC machine using the design data or the sketches.
- CO5 - Draw sectional views of assembled alternator using the design data or the sketches
- CO6 - Design of an electrical machine using the aid of computer.

TEXT / REFERENCE BOOKS

- 1.Yogesh, M., Nagaraja, B., & Nandan, N. (2014). *Computer Aided Electrical Drawing*. PHI Learning Pvt. Ltd.
- 2.M. G. Say, Performance & Design of Alternating Current machines, CBS publishers, E- Edition, 2017
- 3.A.E Clayton & N.N.Hancock, The Performance & Design of DC machines, CBS Publication, E- Edition, 2018.
- 4.Manuals of Auto – CAD

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

**B.E. – ELECTRICAL AND ELECTRONICS ENGINEERING
REGULATIONS 2010 – CURRICULUM**

SEMESTER I

Sl.No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SHSX1001	English for Science and Technology	3	0	0	3	1
2	SMTX1001	Engineering Mathematics – I	3	1	0	4	2
3	SPHX1001	Physics of Materials	3	0	0	3	3
4	SCYX1001	Engineering Chemistry	3	0	0	3	4
5	SCSX1002	Programming in 'C'	3	0	0	3	5
6	SPRX1001	Basic Mechanical and Civil Engineering	3	0	0	3	6
7	SEEX1001	Basic Electrical Engineering	2	1	0	3	7
PRACTICAL							
8	SCSX4002	Programming in C Lab	0	0	4	2	8
9	SEEX4003	Electrical Workshop Lab	0	0	4	2	8
TOTAL CREDITS						24	

SEMESTER II

Sl.No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SCHX1001	Environmental Engineering	3	0	0	3	9
2	SMTX1002	Engineering Mathematics – II	3	1	0	4	10
3	SPHX1002	Applied Physics	3	0	0	3	11
4	SCYX1002	Chemistry of Electronic Materials	3	0	0	3	12
5	SMEX1001	Engineering Graphics	1	2	0	3	13
6	SECX1001	Electronic Devices	3	0	0	3	14
7	SEEX1005	Circuit Theory	3	1	0	4	15
PRACTICAL							
8	SEEX4004	Electrical Circuits Lab	0	0	4	2	16
9	SECX4001	Electronic Devices Lab	0	0	4	2	16
TOTAL CREDITS						24	

L - Lecture hours; T - Tutorial hours; P - Practical hours; C - Credits

SEMESTER III

Sl.No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SMTX1009	Engineering Mathematics III	3	1	0	4	17
2	SCSX1014	Object Oriented Programming	3	0	0	3	18
3	SECX1005	Network Analysis and Synthesis	3	0	0	3	19
4	SECX1014	Electronic Circuits	3	0	0	3	20
5	SMEX1011	Applied Thermodynamics	3	0	0	3	21
6	SEEX1006	Field Theory	2	1	0	3	22
7	SEEX1007	Electrical Machines – I	2	1	0	3	23
PRACTICAL							
8	SEEX4005	Electrical Machines Lab I	0	0	4	2	24
9	SECX4026	Electronic Circuits Lab	0	0	4	2	24
TOTAL CREDITS						24	

SEMESTER IV

Sl.No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SMTX1010	Engineering Mathematics IV	3	1	0	4	25
2	SECX1002	Digital Systems	3	0	0	3	26
3	SCSX1013	Data Structures	3	0	0	3	27
4	SMEX1013	Solid & Fluid Mechanics	2	1	0	3	28
5	SEEX1008	Electrical Machines II	2	1	0	3	29
6	SEEX1009	Transmission & Distribution	3	1	0	4	30
PRACTICAL							
7	SEEX4006	Electrical Machines Lab – II	0	0	4	2	31
8	SCSX4008	Data structures and OOP's Lab	0	0	4	2	31
TOTAL CREDITS						24	

SEMESTER V

Sl.No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SMTX1011	Applied Numerical Methods	3	1	0	4	32
2	SICX1003	Measurements and Instrumentation	3	0	0	3	33
3	SECX1007	Analog Integrated Circuits	3	0	0	3	34
4	SECX1032	Microprocessor Interfacing and its Applications	3	0	0	3	35
5	SEEX1010	Control Systems	3	1	0	4	36
6	SEEX1011	Electrical Machine Design	3	1	0	4	37
7	SEEX1012	Power System Analysis	2	1	0	3	38
PRACTICAL							
8	SECX4006	LDIC Lab	0	0	4	2	39
9	SECX4029	Microprocessor Lab	0	0	4	2	40
TOTAL CREDITS						28	

SEMESTER VI

Sl.No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SECX1071	Digital Signal Processing & Its Applications	3	0	0	3	41
2	SEEX1013	Power Electronics	3	0	0	3	42
3	SEEX1014	Advanced Control Systems	3	1	0	4	43
4	SEEX1015	Power Generation and Utilization	3	0	0	3	44
5		Elective - I	3	0	0	3	
6		Elective - II	3	0	0	3	
7	SEEX4007	Controls & Measurements lab	0	0	4	2	45
8	SEEX4008	Power System Lab	0	0	4	2	45
TOTAL CREDITS						23	

SEMESTER VII

Sl.No.	SUB CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMEX1017	Resource Management Techniques	3	0	0	3	46
2	SECX1066	Principles of Embedded System	3	0	0	3	47
3	SEEX1016	Electrical Drives and Control	3	0	0	3	48
4	SEEX1017	Special Electrical Machines	3	0	0	3	49
5	SEEX1018	Power System Protection and Switchgear	3	0	0	3	50
6		Elective - III	3	0	0	3	
7	SECX4030	Embedded Systems and DSP Lab	0	0	4	2	51
TOTAL CREDITS						20	

SEMESTER VIII

Sl.No.	SUB CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SBAX1001	Principles of Management and Professional Ethics	3	0	0	3	52
2	SEEX1019	High Voltage Engineering	3	0	0	3	53
3		Elective - IV	3	0	0	3	
4	SEEX4009	Power Electronics Lab	0	0	4	2	54
5	S14XPROJ	Project Work	0	0	30	15	54
TOTAL CREDITS						26	
TOTAL CREDITS FOR THE COURSE						200	

ELECTIVES**NOTE: ONE SUBJECT SHOULD BE CHOSEN FROM EACH GROUP COMPULSORILY**

Sl.No.	SUB CODE	SUBJECT TITLE	L	T	P	C	Page No.
Group A							
1	SEEX1020	Flexible AC Transmission System	3	0	0	3	55
2	SEEX1021	Power System Dynamics	3	0	0	3	56
3	SEEX1022	Power System Operation and Control.	3	0	0	3	57
4	SEEX1023	EHV AC and DC Transmission	3	0	0	3	58
5	SEEX1024	Power System Restructuring and Deregulation	3	0	0	3	59
6	SEEX1025	Static Relays	3	0	0	3	60
7	SEEX1028	Non Conventional Energy Resources	3	0	0	3	61
Group B							
1	SEEX1026	Computer Aided Design	3	0	0	3	62
2	SEEX1027	Computer Aided Design of Electrical Equipment	3	0	0	3	63
3	SECX1017	Principles of Communication Engineering	3	0	0	3	64
4	SECX1019	CMOS VLSI Design	3	0	0	3	65
5	SECX1020	NANO Electronics	3	0	0	3	66
6	SECX1022	MEMS & its Applications	3	0	0	3	67
7	SECX1023	Programming in HDL	3	0	0	3	68
Group C							
1	SECX1024	Application Specific Integrated Circuits (ASIC)	3	0	0	3	69
2	SECX1040	Digital Image Processing	3	0	0	3	70
3	SECX1041	Programming in MATLAB	3	0	0	3	71
4	SECX1048	Fundamentals of Fuzzy Logic and Artificial Neural Networks	3	0	0	3	72
5	SICX1016	Fundamentals of Mechatronics	3	0	0	3	73
6	SICX1028	Power Plant Instumentation	3	0	0	3	74
7	SCSX1021	Artificial Intelligence	3	0	0	3	75
Group D							
1	SECX1042	Advanced Electronics Test Engineerig	3	0	0	3	76
2	SICX1009	Biomedical Instrumentation	3	0	0	3	77
3	SICX1020	Theory of Robotics and Automation	3	0	0	3	78
4	SICX1021	Fiber Optics and Laser Instrumentation	3	0	0	3	79
5	SICX1022	Digital Control Systems	3	0	0	3	80
6	SCSX1015	Database Management System	3	0	0	3	81
7	SCSX1017	Data Communication and Computer Networks	3	0	0	3	82

SICX1003	MEASUREMENTS AND INSTRUMENTATION (Common to ECE, ETCE and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I BASIC MEASUREMENTS**6 hrs.**

Functional Elements of measurement system- Examples - Characteristics of instruments: Static characteristics - Dynamic characteristics - Types of errors -sources of errors- methods of elimination-Analysis of data - Limiting errors-Relative limiting error-Combination of Quantities with limiting errors – Statistical treatment of data: Histogram, Mean, Measure of dispersion from the mean, Range, Deviation, Average deviation, Standard Deviation, Variance- Calibration and Standards- Process of Calibration.

UNIT II TRANSDUCERS**8 hrs.**

Transducers –Classification of Transducers, Characteristics - Basic Requirements of a Transducer- Resistive Transducer: Strain Gauge - Inductive Transducer: Linear Variable Differential Transducer - Capacitive displacement transducer, Load cell - Piezoelectric Transducers - Digital transducers – Thermoelectric transducers : Thermocouple, Thermistor, Radiation Pyrometers- Interfacing transducers to measurement systems: IEEE488.

UNIT III ELECTRICAL MEASUREMENTS**8 hrs.**

Measurement of Voltage and Current: D'Arsonval Galvanometer, permanent magnet moving coil, permanent magnet moving iron, Dynamometer - Measurement of Resistance, Inductance and Capacitance: Wheat stone bridge, Kelvin double bridge, Wein Bridge, Hay's bridge, Maxwell bridge, Anderson bridge, Schering bridge – ohmmeter, VOM meter.

UNIT IV ELECTRONIC MEASUREMENTS**8 hrs.**

Signal generators: Function Generators – RF Signal Generators – Sweep generators- Wave Analyzer- Harmonic Distortion Analyzer - Spectrum Analyzer - DC & AC Voltmeters – Digital Voltmeters- Types- Automatic polarity indication, Automatic Ranging, Auto Zeroing- Electronic Multimeters – Digital Multimeters – Frequency Counters- Measurement of Frequency and Time Interval

UNIT V STORAGE AND DISPLAY INSTRUMENTS**10 hrs.**

Cathode Ray Oscilloscopes - Storage Oscilloscope - Digital Storage Oscilloscope – Sampling CRO - Dual Trace Oscilloscopes – Electromechanical servo type XT & XY recorders - LED, LCD, Dot Matrix Display – Magnetic Tape and Disk Recorders/ Reproducers.

TEXT BOOKS:-

1. A.K.Sawhney, "Electrical, Electronic measurement & Instrumentation", Dhanpat Rai & sons, 18th Edition, Reprint 2010
2. Doeblien E.O. "Measurement System Applications and Design", McGraw Hill , 5th Edition, 2004.
3. Albert.D.Helfrick & William.D.Cooper, "Modern Electronic Instrumentation & Measurement Techniques", PHI , 2003.

REFERENCE BOOKS:

1. E.W. Golding and F.C. Widdis, "Electrical Measurements and measuring Instruments", 5th Edition, Wheeler Publications
2. Alan S.Morris, "Principles of Measurements & Instrumentation", PHI , 2nd Edition, 2003

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max.Marks:80

Exam Duration :3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SECX1007	ANALOG INTEGRATED CIRCUITS (Common to ECE, ETCE and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO OPERATIONAL AMPLIFIERS**8 hrs.**

Introduction to IC fabrication steps- Differential amplifier -Current sources-Building blocks for operational amplifier- Monolithic OP-AMP – Ideal operational amplifier – DC and AC Characteristics Input offset voltage- Input bias current- Input offset current- Total output offset voltage- Thermal drift- Slew rate- CMRR -Specifications of typical op-amp(741) – Open loop and closed loop configurations.

UNIT II BASIC OP-AMP APPLICATIONS**8 hrs.**

Inverting amplifier- Non-inverting amplifier- Voltage follower- Summing and differential amplifier -Voltage to current – Current to voltage converters- Integrator- Differentiator- Logarithmic and Anti logarithmic amplifiers-Comparator and Schmitt trigger- Frequency response and compensation.

UNIT III FILTERS AND OSCILLATORS**8 hrs.**

First order and Second order Butterworth filters- low pass, high pass, band pass and band reject filters -RC phase shift, Wein's bridge oscillator- Astable and Monostable multivibrator-Precision half wave and full wave rectifiers.

UNIT IV A/D AND D/A CONVERTERS**8 hrs.**

Sample and Hold circuit – Digital to analog converters: R-2R ladder network and Binary weighted – Characteristics of D/A converters – Analog to digital converters: Flash converter – Successive approximation converter – Dual slope and Oversampling ADCs – Delta Sigma ADC.

UNIT V SPECIAL FUNCTION ICs**8 hrs.**

Analog Multiplier IC AD 533- Phase Locked Loop IC 565– Block schematic – Lock range and capture range – Applications of PLL: FM demodulator and Frequency synthesizer- VCO IC LM 566 – **Timer IC LM 555 and its applications : Astable and Monostable multivibrator – PWM modulator- Positive and Negative Voltage regulators.**

TEXT BOOKS:

1. Sergio Franco, Design with operational amplifiers and analog integrated circuits, 3rd Edition, McGraw-Hill, 1997.
2. D.Roy Choudary, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000.

REFERENCE BOOKS:

1. Grey and Meyer, Analysis and Design of Analog Integrated Circuits, 4th Edition, Wiley International, 2001.
2. Michael Jacob, Applications and Design with Analog Integrated Circuits, 2nd Edition, Prentice Hall of India, 1993.
3. Ramakant A.Gayakwad, OP-AMP and Linear ICs, 4th Edition, Prentice Hall / Pearson Education, 1994.
4. William D.Stanely, Operational Amplifiers with Linear Integrated Circuits, 4th Edition, Pearson Education, 2004.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SECX1032	MICROPROCESSOR INTERFACING AND ITS APPLICATIONS (Common to ECE, EEE and ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO 8085**8 hrs.**

Intel 8085 Microprocessor architecture – signals – Addressing modes – Instruction classification Instruction set—Timing diagram – ALP format – Programming 8085 – 8-bit and 16-bit Operation including stack-subroutine –Introduction to interrupt handling and related instructions – comparison of 8085 with z80 and 6800.

UNIT II PERIPHERAL ICS**8 hrs.**

PPI 8255 – Programmable keyboard display –Interface 8279 – Programmable interrupt controller 8259 –Programmable DMA controller 8257 –USART 8251 –Programmable interval timer 8253.

UNIT III INTERFACING WITH 8085/8086**8 hrs.**

Stepper motor control – Temperature control – ADC – DAC – 7-segment display – Comparison of 8085 with Z 80 & 6800 – RS 232-RS 422-RS 485 – Alphanumeric LCD display.

UNIT IV 16 BIT PROCESSOR**8 hrs.**

Architecture of 8086 – signals – addressing modes – minimum & maximum mode of operation – Instruction set – Assembly language programs in 8086 – 8284 clock driver.

UNIT V ADVANCED PROCESSORS**8 hrs.**

Review of Processor and its types – 80286 – 80386 – 80486 – Introduction to Pentium family – MMX architecture and instruction set – Core 2 duo and Core 2 Quad Processor.

TEXT BOOKS:

- 1.Ramesh Goankar, Microprocessor Architecture Programming and Applications with 8085 / 8088, 5th Edition, Penram International Publishing.
2. A.K.Ray and Bhurchandi, Advanced Microprocessor, 1st Edition, TMH Publication.

REFERENCE BOOKS:

1. Douglas V.Hall, Microprocessors and Digital system, 2nd Edition, Mcgraw Hill, 1983.
2. A.K.Ray and K.M.Bhurchandi, Advanced microprocessors and peripherals- Architecture, Programming and interfacing, TMH, 2002.
3. P.K.Ghosh and P.R.Sridhar, Introduction to Microprocessors for Engineers and Scientist, 2nd Edition, PHI, 1991.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SEEX1010	CONTROL SYSTEMS (Common to EEE, ECE, ETCE, E&C and EIE)	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I SYSTEM CONCEPTS**10 hrs.**

Types of system – open loop systems, closed loop systems, Basic elements in control system – Mathematical models of physical system: Differential equation- transfer functions of simple electrical networks, Electrical analogous of mechanical translational and Rotational system – D.C and A.C servomotor – Mechanical system- Translational and Rotational system – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE ANALYSIS OF CONTROL SYSTEMS**8 hrs.**

Standard test signals -Time response of first and second order system, Time domain- specifications- Generalized error series – Steady state error and error constants.

UNIT III STABILITY OF CONTROL SYSTEM**8 hrs.**

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Nyquist stability criterion.

UNIT IV FREQUENCY RESPONSE ANALYSIS**8 hrs.**

Frequency response of the system – Correlation between time and frequency response – Gain and Phase margin – Bode plot.

UNIT V COMPENSATION AND CONTROLLERS**6 hrs.**

Introduction to compensation networks – Lag, Lead and Lag Lead networks – Compensator Design – P, PI, PID Controllers design using Bode plot.

TEXT BOOKS:

1. Ashok Kumar, "Control Systems", TMH Ltd, 1ST Edition, 2006.
2. Kausuhio Ogata, "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd Edition, 1998.
3. Smarajit ghosh, "Control System Theory & applications", 2nd Edition, Pearson Education, Publishers, 2005

REFERENCE BOOKS:

1. I.J.Nagrath and M.Gopal, "Control Systems Engineering", New Age International (P) Limited, Publishers, 2nd Edition, 2009
2. M.N. Bandy Pathy, "Control Engineering, Theory and Practice", PHI, 1st Edition, 2005.
3. N.K Sinha, "Control Systems", New Age International(p) Limited, Publishers, 3rd Edition, 1998
4. Roy choudhury, "Modern control engineering", prentice hall of India, 2nd Edition, 2005,
5. Richard Dorf, "Modern Control Systems", Pearson Education Ltd, 8th Edition. 2005.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

(Distribution may be 30% Theory & 70 % Numerical)

SEEX1011	ELECTRICAL MACHINE DESIGN	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I BASIC CONCEPTS OF DESIGN**8 hrs.**

Standard specifications – Electrical Engineering materials – High conductivity materials – Insulating materials – Magnetic circuit calculations – mmf for airgap and iron path – Choice of specific electric and magnetic loading

UNIT II DC MACHINES**10 hrs.**

Output equation – Main Dimension – Choice of number of poles – Armature and field coil design – Design of commutators and Brushes – Performance calculation

UNIT III TRANSFORMERS**8 hrs.**

Output equation – Design of core and winding of single phase – Shell and core type transformer and three phase transformer – Design of tank and cooling tubes and Ducts

UNIT IV THREE PHASE INDUCTION MACHINES**8 hrs.**

Output equation, Main dimensions, Design of stator, Design of rotor – squirrel cage and slip ring, Choice of L/D ratio – Air gap length

UNIT V SYNCHRONOUS MACHINES**6 hrs.**

Output equation – Design of salient pole rotor machine – Dimensions – Short circuit ratio – Effect of Short Circuit ratio – Air gap length – Armature design – Slot dimension – Rotor design of damper winding – Design of cylindrical rotors.

TEXT BOOKS:

1. A.K.Sawhney, A.Chakrabarti, "A course in Electrical machine Design", Dhanpat Rai and Sons, New Delhi, 6th Edition, 2006.

REFERENCE BOOKS:

1. Albert E. Clayton and NN Hancock, "The performance and Design of Direct Current Machines", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1990.
2. A.Nagoorkani, "Electrical Machine Design", RBA Publications, 2nd Edition, 2000
3. R.K.Agarwal, "Principles of Electrical Machine Design", Reprint 2002, S.K.Kataria & Sons, 4th Edition.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

(Distribution may be 40% Theory & 60 % Numerical)

SEEX1012	POWER SYSTEM ANALYSIS	L	T	P	Credits	Total Marks
		2	1	0	3	100

UNIT I POWER SYSTEM MODELING**6 hrs.**

Need for system analysis in planning and operation of power system — per phase analysis of symmetrical three-phase system. General aspects relating to power flow, short circuit and stability analysis – per unit representation- symmetrical component transformation – sequence impedances.

UNIT II FORMATION OF BUS MATRIX**8 hrs.**

Primitive network and its matrices – bus incidence matrix – bus admittance by analytical method and direct inspection method- bus impedance matrix formation. Modeling of generator, load, shunt capacitor, transmission line, shunt reactor for short circuit, power flow and stability studies.

UNIT III SHORT CIRCUIT ANALYSIS**10 hrs.**

Need for short circuit study. Approximations in modeling – calculation for radial networks. Symmetrical short circuit analysis – Z bus in phase frame and in sequence frame fault matrices – unsymmetrical fault analysis.

UNIT IV POWER FLOW ANALYSIS**8 hrs.**

Problem definition – bus classification – derivation of power flow equation – solution by Gauss Seidel and Newton Raphson methods – P V bus adjustments for both methods – computation of slack bus power, transmission loss and line flow.

UNIT V STABILITY & SECURITY ANALYSIS**8 hrs.**

Distinction between steady state and transient state – Concepts of Stability & Security – Swing equation-solution to swing equation – step by step method – power angle equation – equal area criterion – critical clearing angle and time. Stability analysis of single machine connected to infinite bus by modified Euler's method – Multi-machine stability analysis using Runge Kutta method.

TEXT BOOKS:

1. John J. Grainger and Stevenson Jr. W.D., "Power System Analysis", Tata McGraw Hill, 2003.
2. Nagarath .I.J., Kothari .D.P., "Power system Engineering", 2nd Edition, Tata McGraw Hill, 2008.

REFERENCE BOOKS:

1. Stagg, G.W. and El-Abid, A. H. "Computer Methods in Power System Analysis", McGraw-Hill International Book Company, 1994.
2. Nagarath, I.J., and Kothari, D.P., "Modern Power System Analysis", 3rd Edition, Tata McGraw Hill Publishing Company, 2003.
3. Hadi Saadat, "Power system Analysis", 2nd Revised Edition, Tata McGraw Hill Publishing Company, 2009.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

(Distribution may be 20% Theory & 80% Numerical)

SECX4029	MICROPROCESSOR LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

List of Experiments

I. Programs using 8085 Processor

1. Programs for 8 bit Addition, Subtraction, Multiplication, Division.

II. Programs using 8086 Processor

1. Perform 32 bit, 64 bit addition.
2. Swapping a word, counting numbers of 1's in word.
3. Arithmetic mean of N Numbers, Arithmetic mean of Square of N Numbers.
4. Code Conversion – BCD to ASCII Conversion

ASCII to BCD Conversion.

5. Finding largest & smallest of given Numbers.
6. To Sort given set of Numbers in Ascending & Descending Order.
7. Program using look up table Concept.
8. Matrix Manipulation – 16 bit addition
16 bit Multiplication
9. Perform LCM, GCD.
10. Generate Fibonacci Series, Factorial of given Numbers.

III. Interfacing with 8086

1. Interfacing 8086 with Stepper motor. Use Step angle Calculation & rotate motor to a Specified angle.
2. Interface 8086 with DC motor & Control the Speed of the DC Motor.
3. Interface 8086 With ADC & display the digital input.
4. Interface 8086 With DAC & display the following waveform in CRO.

Triangular

Saw tooth

Staircase

5. Interface 8086 with 7 segment display to display numbers as Characters.
6. Interface 8086 with LCD to display the name of the person.

SECX1071	DIGITAL SIGNAL PROCESSING & ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I DISCRETE – TIME SIGNALS AND SYSTEMS**10 hrs.**

Sampling of Analog signals – aliasing – standard discrete time signals – classification – discrete time systems – Linear time invariant stable casual discrete time systems – classification methods – linear and circular convolution – difference equation representation – DFS, DTFT, DFT – FFT computations using DIT and DIF algorithms. Time response and frequency response analysis of discrete time systems to standard input signals.

UNIT II INFINITE IMPULSE RESPONSE DIGITAL FILTERS**8 hrs.**

Review of design of analog Butterworth and Chebyshev Filters, Frequency transformation in analog domain – Design of IIR digital filters using impulse invariance technique – Design of digital filters using bilinear transform – pre warping – Frequency transformation in digital domain – Structure realization of IIR Filter

UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS**8 hrs.**

Symmetric and Antisymmetric FIR filters – Linear phase FIR filters – Design using Frequency sampling technique – Window design using Hamming, Hanning and Blackmann Windows – Concept of optimum equiripple approximation – Structure realization of FIR Filters

UNIT IV FINITE WORD LENGTH EFFECTS**6 hrs.**

Quantization noise – derivation for quantization noise power – Fixed point and binary floating point number representations – Comparison – Overflow error – truncation error – coefficient quantization error – limit cycle oscillations- signal scaling.

UNIT V DIGITAL SIGNAL PROCESSOR**8 hrs.**

TMS 320 family overview - TMS 320 C24X series of DSP controller -Architectural Overview- Memory and I/O spaces – Central Processing unit – Addressing modes, Event Manager, simple programs for PWM generation, speed control of PMDC motor control.

TEXT BOOKS

1. John. G. Proakis, Dimitris. G. Monolakis, D. Sharma, "Digital Signal Processing", Pearson Education, 2006.
2. Sanjit K Mitra, "Digital Signal Processing", Tata Mc Graw-Hill, 3rd Edition 2006.
3. Texas Instruments, "TMS320LF/LC240X DSP Controller Reference Guide- CPU and Instructions", www.ti.com, Texas Instruments Literature SPRU357A.
4. Texas Instruments, "TMS320LF/LC240X DSP Controller Reference Guide-System and Peripherals", www.ti.com, Texas Instruments Literature SPRU357B.

REFERENCE BOOKS

1. Hamid. A. Toliyat, Steven. G. Campbell, "DSP –Based Electromechanical motion control" CRC press-2004.
2. P. Ramesh babu, "Digital Signal Processing", Scitech Publications pvt Ltd. 2005.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SEEX1013	POWER ELECTRONICS (Common to EEE, EIE, ECE, ETCE and E&C)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I POWER SEMICONDUCTOR DEVICES**8 hrs.**

Overview of V-I characteristics of switching devices – Power Diode, BJT, Switching characteristics of power MOSFETS, IGBT and Thyristor – SCR Protection circuits – firing circuits – Commutation techniques.

UNIT II PHASE CONTROLLED RECTIFIERS**8 hrs.**

Principle of phase controlled converter operation – single phase semi converter & full converter with R, RL & RLE load – Freewheeling diode – Inverter operation of full converter – Three phase Semi converter & full converter with RLE load.

UNIT III DC & AC CHOPPERS**8 hrs.**

DC – DC Chopper: Step down and step up choppers – One, two and four quadrant operation.

AC – AC Chopper: Single phase AC voltage controllers with R & RL load – Multistage sequence control. Single phase step up and step down cycloconverters.

UNIT IV INVERTERS**8 hrs.**

Principle of operation : Single phase half bridge & full bridge voltage source inverters – Three phase Voltage source inverters (120° and 180° mode) – Single phase current source inverter. PWM techniques : Single pulse PWM, Sinusoidal PWM, Modified sinusoidal PWM and multiple PWM

UNIT V APPLICATIONS**8 hrs.**

SMPS : Flyback and Push Pull – UPS : Redundant and Non-Redundant – HVDC Transmission systems – Single phase full converter fed DC drives. Inverters for standalone and grid connected photovoltaic systems.

TEXT BOOKS:

1. Rashid M.H., "Power Electronics circuits Devices and Applications", Prentice Hall, 3rd Edition, New Delhi, 2004
2. P.S.Bimbhra, "Power Electronics", Khanna Publishers, 3rd Edition, 2003

REFERENCE BOOKS:

1. P.C.Sen, " Power Electronics", Tata Mc Graw Hill Company, New Delhi, 1987.
2. M.D.Singh and K.B.Khanchandani, "Power Electronics" TMH, New Delhi, 2nd Edition, 2007.
3. Dubey G.K., Doradla S.R., Joshi A and Sinha R.M., "Thyristorised Power Controllers" – Wiley Eastern Limited 1986.
4. Ned Mohan, " Power Electronics", 2nd Edition, 2001.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

(Distribution may be 90% Theory & 10 % Numerical)

SEEX1014	ADVANCED CONTROL SYSTEMS	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I STATE SPACE MODEL**8 hrs.**

Introduction to state space, state variables, Physical Variables, phase variables-Matrices, Eigen values and Eigen vectors-Diagonalization, Canonical and Jordan forms- State space models from differential equations – conversion of state variable models to transfer function

UNIT II MATHEMATICAL ANALYSIS**6 hrs.**

Computation of state transition matrix – Laplace transformation method, canonical transformation – Cayley Hamilton theorem-Solution of state equation.

UNIT III STATE FEEDBACK AND OBSERVERS**6 hrs.**

Concepts of controllability and observability – Design of state space feed back using pole placement technique- State Observers.

UNIT IV SAMPLED DATA SYSTEMS**10 hrs.**

Introduction to digital control – discrete time signals – sampling process – analysis of sampling process in the frequency domain – spectral representation – analyzing – Shannon's sampling theorem – Reconstruction of sampled signals using hold circuits – zero order hold – its representation – Bode plot of hold circuit – Z – transform of sampled signals – theorems on Z- transform – inverse Z-transform – mapping between s and z planes – pulse transfer function impulse response – closed loop operation – Characteristic equations – Jury's stability criterion.

UNIT V NONLINEAR SYSTEMS**10 hrs.**

General properties of non-linear systems – Describing function method – on / off, dead zone, saturation and hysteresis non linearities – determination of limit cycle by describing function – stability of limit cycle – system stability in the sense of Lyapunov – Lyapunov's direct method – stability and instability theorems – application of Lyapunov method for linear systems- Basic concepts of phase plane method.

TEXT BOOKS:

1. K.Ogata, "Modern control Engineering", 3rd Edition, Prentice Hall India, New Delhi. 2009.
2. B.C.Kuo, "Automatic Control Systems", Phi learning Pvt Ltd, 8th Edition, 2009.

REFERENCE BOOKS:

1. Phillips C.L., & harbor R.D. "Feedback Control Systems" 3rd Edition, Prentice Hall International. 1999.
2. Naresh K. Sinha, "Control Systems", New Age International Ltd., 1998.
3. Stanley M.Shinners, "Modern Control System Theory and Design", 2nd Edition, John Wiley & Sons. 1998.
4. M.Gopal, "Digital Control and State Variable Methods", 2nd Edition, Tata McGraw Hill Ltd., New Delhi, 2003.
5. Roy Choudhry, "Modern Control Engineering" Phi Learning, 2009

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

(Distribution may be 30% Theory & 70 % Numerical)

SEEX1015	POWER GENERATION AND UTILIZATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I CONVENTIONAL POWER PLANTS**8 hrs.**

Layout and working of diesel, steam, low and high head power plants-pumped storage plants-principle of nuclear power generation – types and layouts of nuclear reactors- boiling water reactor- advanced gas cooled reactor- fast breeder reactor – reactor control – waste disposal.

UNIT II NON CONVENTIONAL POWER PLANTS**8 hrs.**

Basic concepts – principle of working and layout of MHD, solar, wind, tidal, biogas, biomass and geothermal power generation, fuel cells.

UNIT III ILLUMINATION**8 hrs.**

Nature of radiation – definition-laws-lighting calculations-polar curves-Rousseau construction- design of lighting schemes for industrial, flood and street – Electric lamps- gas discharge lamps- sodium vapour, mercury vapour, neon sign lamps, CFL and LED lamps.

UNIT IV HEATING AND WELDING**8 hrs.**

Introduction – methods of heating – design of heating element- resistance, inductance, arc furnaces- high freq. dielectric heating- welding – types- resistance, arc welding- construction and its characteristics.

UNIT V ELECTRIC TRACTION AND DRIVES**8 hrs.**

Introduction – requirements of an ideal traction- mechanics of train movement – tractive effort calculations- electrical braking – shunt and bridge transitions- trolley buses and tramways- electric drive- selection of motors- textile, printing, lift, ships.

TEXT BOOKS:

1. Uppal.S.L. "Electrical Power", Khanna Publishers, 9th Edition, 2001.
2. Openshaw Taylor, "Utilisation of Electrical Energy", Oriented Longmans Ltd, (Revised in SI Units) 1981, SI Edition.
3. Er.R.K.Rajput, "Utilization of Electrical power", Laxmi Publications, 2006.

REFERENCE BOOKS:

1. Soni Bhatnagar & Gupta, "A Course in Electrical Power", Dhanpat Rai & Sons 1996.
2. Starr A.T., "Generation, Transmission and Utilisation of Electric Power", ELBS, 1978.
3. C.L.Wadhwa, "Generation, Distribution & Utilisation of Electrical Energy", Wiley Eastern Ltd, New Delhi, 1993.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

(Distribution may be 90% Theory & 10 % Numerical)

SEEX4007	CONTROLS & MEASUREMENTS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

List of Experiments

1. Transfer function of DC generator
2. Transfer function of Field controlled DC motor
3. Transfer function of Armature controlled DC motor
4. Speed Control of Ward Leonard system
5. Transfer function of lag, lead and lag- lead network
6. Measurement of self inductance by Maxwells inductance bridge
7. Calibration of Ammeter, Voltmeter and Wattmeter
8. Calibration of Three phase energy meter
9. Instrumentation Amplifier
10. Study of LVDT and Pressure Transducer
11. Design of P,PI and PID controller
12. Study of temperature measuring transducers (Thermocouple)

SEEX4008	POWER SYSTEM LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

List of Experiments

1. Per unit Calculation.
2. Y- Bus, Z-Bus formation.
3. Power flow By Gauss seidel method.
4. Power flow By Newton-Raphson method.
5. Swing Equation.
6. Fault Analysis.
7. Characteristics of over current relay.
8. Characteristics of Frequency relay.
9. Construction of simple ladder program for AND Logic and OR Logic.
10. Introduction to motor control using SCADA.
11. Process control Automation.
12. Line Modeling.

SMEX1017	RESOURCE MANAGEMENT TECHNIQUES (Common to all branches)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION AND LINEAR PROGRAMMING**8 hrs.**

Operations Research(OR)-Nature-Characteristics-Phases.-Role of OR in Decision making- Outline of OR Models
Linear Programming – Formulation of L.P.problems –Solution by graphical method, simplex method, and big M methods
– Applications of O.R. in production management

UNIT II TRANSPORTATION AND ASSIGNMENT MODEL**8 hrs.**

Transportation problem – Initial Basic feasible solution- Northwest corner method, Least Cost method, Vogel's approximation method – Test for optimality-MODI method

Assignment problems- Hungarian assignment models- Travelling salesman problems

UNIT III RESOURCE SCHEDULING AND NETWORK ANALYSIS**8 hrs.**

Problem of Sequencing – Problem with N jobs and 2 machines N Jobs 3 m/cs and 2 Jobs m m/cs (Graphical method). Project Management – Basic concepts – Network construction and scheduling CPM & PERT Program evaluation and resource leveling by network techniques, time – Cost trade off.

UNIT IV INVENTORY CONTROL AND SIMULATION**8 hrs.**

Inventory Control – Various Types of inventory models – deterministic inventory models – Production model, Purchase model– with and without shortage- EOQ – Buffer stock – Shortage quantity, Probabilistic inventory models
– Quantity Discount and Price Breaks Simulation – Use, advantages & limitations, Monte –Carlo simulation, application to queuing, inventory & other problems

UNIT V QUEUEING THEORY, GAME THEORY AND REPLACEMENT MODELS**8 hrs.**

Queueing theory – Poisson arrivals and exponential service times, Single channel models only. Game theory-Pay off matrix, competitive games with pure strategy, minimax criterion, principles of dominance & mixed strategies
Replacement policy for items whose maintenance cost increases with time- Consideration of time value of money value- Replacement policy- Individual, Group replacement of items that fail completely

TEXT BOOK:

1. Kanti Swarup, P.K.Gupta, & Manmohan., Operations Research – S. Chand & Sons.

REFERENCE BOOKS:

1. K.V.Mital and C.Mohan, "Optimization Methods in O.R and System Analysis ", New Age International Publishers.
2. S.D.Sharma, "Operations Research", Kedarnath Ramnath & Co, 2002.
3. Hamdy A. Taha, "Operations Research", 5th Edition, PHI, 1995
4. Hillier & Liberman, "Introduction to operation research", 5th Edition, McGraw Hill, 2001.
5. Ravindran, Phillips & Solberg, "Operations Research: principles and practice", 2nd Edition, Wiley India Lts, 2007

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SECX1066	PRINCIPLES OF EMBEDDED SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I 8051 MICROCONTROLLER ARCHITECTURE**8 hrs.**

Comparison of microprocessors and microcontrollers – 8051 architecture – hardware, I/O pins, Ports, Memory, counters, timers, serial I/O interrupts.

UNIT II PROGRAMMING OF 8051**8 hrs.**

Addressing modes – instruction sets – simple programs with 8051 – Addition, Subtraction, BCD addition, Multiplication, I/O Programming.

UNIT III RISC EMBEDDED CONTROLLERS**8 hrs.**

Comparison of CISC and RISC controllers – introduction to PIC microcontrollers – PIC 16F877 architecture – memory organization – addressing modes – assembly language instructions.

UNIT IV DISTRIBUTED EMBEDDED SYSTEM DESIGN**8 hrs.**

Distributed Embedded system – Embedded networking – RS 232 – RS485 – Inter-integrated circuit (I²C) – serial peripheral interface (SPI) – Universal serial Bus (USB) – Controller Area Network (CAN)

UNIT V REAL TIME OPERATING SYSTEMS**8 hrs.**

Introduction – Desktop OS versus RTOs – Task management – Task scheduling – Race conditions – Priority Inversion – RTOs – Under the Hood – ISRs and Scheduling – Inter – task Communication – Timers.

TEXT BOOKS:

1. Kenneth. J. Ayala, 'The 8051 Microcontroller Architecture, Programming and Applications', Penram International, 1996, 2nd Edition, ISBN 81-900828-4-1.
2. Sriram. V. Iyer, Pankaj Gupta, 'Embedded Real Time Systems Programming', 2004 Tata Mc Graw Hill Publishing company limited, 2006, ISBN 0-07-048284-5.

REFERENCE BOOKS:

1. Frank Vahid, Tony Givargis, 'Embedded system Design – A unified Hardware / software Introduction', John Wiley and Sons, 2002, ISBN 9971-51-405-2.
2. Todd D Morton, 'Embedded microcontrollers', Reprint by 2005, Low Price Edition, ISBN 81-297-0226-6.
3. Muhammed Ali Mazidi, Janice Gillispie Mazidi, 'The 8051 Microcontroller and Embedded Systems', Low price Edition, Second Impression 2006.
4. Raj Kamal, 'Embedded Systems-Architecture, Programming and Design', Tata Mc Graw Hill Publishing company limited 2003, ISBN 0-07-049470-3.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max.Marks : 80

Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SEEX1016	ELECTRIC DRIVES AND CONTROL	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I CHARACTERISTICS OF ELECTRIC DRIVES**8 hrs.**

Electric drives – Advantages – Classes of duty. Speed – Torque Characteristics of various types of loads and drive motors – selection of power rating for drive motors with regard to thermal. Overloading and load variation factors – load equalization – Starting, braking and reversing operations.

UNIT II DC DRIVE**8 hrs.**

Speed control of DC motors – Ward Leonard scheme – Drawbacks – Thyristor converter fed DC Drives: single and four quadrant operations. Chopper fed DC Drives: Time ratio control and current limit control – single, two and four quadrant operation.

UNIT III THREE PHASE INDUCTION MOTOR DRIVES**10 hrs.**

Speed control of three phase induction motors: Stator control – Stator voltage and frequency control – AC Chopper and Cycloconverter fed induction motor drives. Rotor control – Rotor resistance control and slip power recovery schemes – Static control of rotor resistance using DC Chopper – Static and Scherbius drives – Introduction to vector control based drives, Direct and Indirect Vector Control.

UNIT IV THREE PHASE SYNCHRONOUS MOTOR DRIVES**8 hrs.**

Speed control of three phase synchronous motors – Voltage source and current source converter fed synchronous motors – Commutatorless DC motor- Cycloconverter fed synchronous motors – Effects of harmonics on the performance of AC motors – Closed loop control of drive motors, Marginal angle control and power factor control.

UNIT V DIGITAL CONTROL AND DRIVE APPLICATIONS**6 hrs.**

Digital techniques in speed control – Advantages and limitations – DSP based control of drives – Selection of drives and control schemes for steel rolling mills. Paper mills, lifts and cranes.

TEXT BOOKS:

1. Gopal K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.
2. Gopal K. Dubey, "Fundamentals of Electrical Drives", Alpha Science International Ltd, 2001.

REFERENCE BOOKS:

1. Vedam Subramanyam, "Thyristor control of Electric Drives", Tata Mc Graw Hill, New Delhi 1991.
2. S.K.Pillai, "A First Course on Electrical Drives", New age international Publishers Pvt Ltd, 1989, Reprint 2004.
3. P.C.Sen, "Thyristor DC Drives", John Wiley & Sons New York 1981.
4. B.K.Bose, "Power Electronic & AC drives", Prentice Hall, 2006.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam

Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SEEX1017	SPECIAL ELECTRICAL MACHINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I STEPPING MOTORS**8 hrs.**

Constructional features, principle of operation, types, modes of excitation, Torque production in Variable Reluctance (VR) stepping motor, Static and Dynamic characteristics, Introduction to Drive systems for open loop control, Closed loop control of stepping motor-Applications.

UNIT II SWITCHED RELUCTANCE MOTORS**8 hrs.**

Principle of Operation, Constructional features, Torque equation, Power Semi Conductor Switching Circuits, Torque – Speed Characteristics, Microprocessor based control of SRM Drive, Applications.

UNIT III SYNCHRONOUS RELUCTANCE MOTORS**8 hrs.**

Constructional features: axial and radial air gap Motors. Operating principle, reluctance torque – phasor diagram, Speed torque characteristics, Applications.

UNIT IV PERMANENT MAGNET BRUSHLESS DC MOTORS**8 hrs.**

Commutation in DC motors, Electronic Commutation, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Construction and principle of PMBL DC Motor, Torque and Emf equation, Torque-speed characteristics, Power Controllers-Drive Circuits, Applications.

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS**8 hrs.**

Construction and types, Principle of operation, EMF, Torque Speed Characteristics, Power controllers, Self control, Vector control, Microprocessor based Control, Applications.

TEXT BOOKS:

1. Miller, T.J.E. "Brushless permanent magnet and reluctance motor drives", Clarendon Press, Oxford, 1989.
2. Kenjo.T, "Stepping motors and their microprocessor control", Oxford University Press, 1995.
3. R.Krishnan, "Electric Motor Drives – Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., New Delhi, 2009.

REFERENCE BOOKS:

1. Kenjo.T and Naganori, S "Permanent Magnet and brushless DC motors", Clarendon Press, Oxford, 1989.
2. B.K. Bose, "Modern Power Electronics & AC drives", Dorling Kindersley India, 2006.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SEEX1018	POWER SYSTEM PROTECTION AND SWITCHGEAR	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION**8 hrs.**

Essential requirements of protection – nature and causes of faults – types of faults – effects of faults – zones of protection – protection schemes – CTs and PTs and their applications – Basic relay terminology.

UNIT II PROTECTIVE RELAYS**8 hrs.**

Electromagnetic relays – operating principle – torque equation – relay characteristics – over current relay, directional relay, distance relay, differential relay, negative sequence relay, amplitude and phase comparator of over current static relays, duality between comparators. Micro processor based over current relay.

UNIT III APPARATUS PROTECTION**8 hrs.**

Protection of Generator– stator & rotor protection – Large Motor protection. Transformer protection – Bus bar protection – Transmission line protection.

UNIT IV THEORY OF ARC QUENCHING**8 hrs.**

Arcing phenomena – theory and methods of arc quenching – recovery voltage – restriking voltage – RRRV – resistance switching – current chopping – capacitive current breaking – characteristics of fuses – HRC fuse.

UNIT V CIRCUIT BREAKERS**8 hrs.**

Classification of circuit breakers – air circuit breakers – oil circuit breakers – vacuum circuit breaker – SF₆ circuit breakers – selection of circuit breakers – rating of circuit breakers – testing of circuit breakers.

TEXT BOOKS:

1. Sunil S.Rao "Switchgear and protection", Khanna publishers, New Delhi, 2008.
2. Badri Ram and D.N.Vishwakarma " Power System Protection and Switchgear", Tata McGraw Hill publishing, new Delhi, 2005.

REFERENCE BOOKS:

1. S.L.Uppal, "Electrical Power", Khanna publishers, New Delhi, 1995.
2. Soni, Gupta and Bhatnagar "A Course in Electrical power", Dhanpat Rai&sons, New Delhi, 2010.
3. Tsm Rao, "Digital Numerical Relays", Tata McGraw Hill publishing, New Delhi, 2005.
4. B.Ravindranath and N.Chander, " Power System Protection and Switchgear", New age International (P) Ltd, 2005.
5. Dr.N.Veerappan and Dr.S.R.KrishnaMurthy, "Power System Switchgear and Protection",S.Chand,2009.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

(Distribution may be 90% Theory & 10 % Numerical)

SECX4030	EMBEDDED SYSTEMS AND DSP LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

List of Experiments

EMBEDDED LAB

1. Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051 microcontroller.
2. Programming and verifying Timer, Interrupts and UART operations in 8051 microcontroller.
3. Programming using Arithmetic, Logical and Bit Manipulation instructions of PIC 16F877 microcontroller.
4. Programming and verifying Timer, Interrupts and UART operations in PIC 16F877 microcontroller.
5. Interfacing and Programming of LED's and LCD display.
6. Interfacing and Programming of Stepper Motor and DC Motor Speed control.

DSP LAB

I. USING TMS320CX2407 DSP Processor

1. Addition, Subtraction, and Multiplication.
2. Single pulse fixed PWM generation using general purpose Timers.
3. Two pulse fixed PWM generation using Timer 1 and Timer 2.
4. Six pulse fixed PWM generation using full compare unit.
5. Six pulse fixed PWM generation with dead band.
6. Two pulse variable PWM generation with dead band using full compare unit.

II. Using MATLAB

1. Generation of AC Signals.
2. FIR filter design using windowing method.
3. IIR filter design using Butter worth Approximation

SBAX1001	PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS	L	T	P	Credits	Total Marks
		3	–	–	3	100

UNIT I MANAGEMENT FUNCTIONS & STRUCTURE**8 hrs.**

Management – Definition – Basic Function – Contribution of Taylor & Fayol. Types of structure – Line, staff, Functional, Committee, Project & Matrix – Structures.

Departmentalization – Centralization – Decentralization – span of control. Management By Objectives – Management By Exception.

UNIT II MANAGEMENT OF ORGANISATION**8 hrs.**

Forms of Business / Industrial Ownership – Sole Trader, Partnership, Company, Performance Appraisal – Basic Principles – Pitfalls – Methods to Overcome. Industrial Safety – Causes of Accidents – Cost of Accident – How to minimize Accidents. Plant Layout & Maintenance – Need, Types & Managerial Aspects.

UNIT III ORGANISATIONAL BEHAVIOUR**8 hrs.**

OB – Definition – Nature & Scope – Contributing Disciplines – Importance of OB to Managers. Personality – Definition – Theories – Factors Influencing Personality. Motivation – Definition – Theories. Theory X & Y – Transactional Analysis. Morale & Job Satisfaction – Factors Influencing Job Satisfaction.

UNIT IV GROUP DYNAMICS**8 hrs.**

Group – Definition – Types – Determinants of Group Cohesiveness – Communication – Process – Barriers – Effective Communication. Leadership Theories – Factors Contributing to Effective Leadership – Role of Trade Union in Organizations – Functions of Trade Union – Why Trade Union is required? – Types of Trade Union.

UNIT V PROFESSIONAL ETHICS**8 hrs.**

Ethics in Workplace – Formulation of Ethics – Managerial Ethics – Managing Ethical Behaviour – Codes of Ethics – Encouraging Ethical Behaviour – Social Responsibility – Spirituality.

TEXT / REFERENCE BOOKS

1. Gupta C.B., Management Theory and Practice, 14th Edition, Sultan Chand & Sons, 2009.
2. Dr. Prasad L.M., Principle & Practice of Management, 7th Edition, Sultan Chand & Sons, 2008.
3. Aswathappa, Organisational Behaviour, 8th Edition, Himalaya Publishing House, 2010.
4. Dr. Prasad L.M., Organisational Behaviour, 4th Edition, Sultan Chand & Sons, 2008.
5. Harold Koontz, Principles of Management, 1st Edition, Tata McGraw Hill, 2004.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SEEX1019	HIGH VOLTAGE ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I CONDUCTION AND BREAKDOWN OF GASEOUS INSULATING MATERIALS 8 hrs.

Ionization of gases and current growth – Townsend's criterion for breakdown – Breakdown in electronegative gases – Time lags for breakdown – Paschen's Law – Corona discharges – Breakdown in non-uniform fields – Practical considerations for selecting gases for insulation purposes.

UNIT II CONDUCTION AND BREAKDOWN IN LIQUID AND SOLID DIELECTRICS 8 hrs.

Various mechanisms of breakdown in liquid dielectrics – Liquid dielectrics used in practice – Various processes of breakdown in solid dielectrics – Solid dielectrics used in practice.

UNIT III GENERATION OF HIGH VOLTAGES AND CURRENTS 8 hrs.

Generation of high DC voltages using voltage multiplier circuits – Van de Graffe generator – Generation of high alternating voltages using cascade transformers – Production of high frequency AC high voltages – Standard impulse wave shapes – Marx circuit – Generation of switching surges – Impulse current generation – Tripping and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND CURRENTS 8 hrs.

High DC voltage measurement techniques – Methods of measurement for power frequency AC voltages – Sphere gap measurement technique – Potential divider for impulse voltage measurements – Measurement of high D.C. A.C, and impulse currents – Use of CRO for impulse voltage and current measurements.

UNIT V TESTING OF ELECTRICAL APPARATUS& INSULATION CO-ORDINATION 8 hrs.

Tests on insulators – Testing of bushings – Testing of isolators and circuit breakers – Cable testing – Testing of transformers – Surge diverter testing – Radio interference measurement –Insulation Coordination.

TEXT BOOK:

1. M.S.Naidu and V.Kamaraju, "High Voltage Engineering" – Tata McGraw Hill, 3rd Edition, 2004.

REFERENCE BOOKS:

1. E.Kuffel and M.Abdullah, "High Voltage Engineering" – Pergamon Press, Oxford, 1970.
2. C.L.WADHWA, "High Voltage Engineering" – New Age International (P) Ltd, Publishers, 2007
3. E.Kuffel and W.s. Zaengal, "High Voltage Engineering Fundamentals", 2nd Edition, Butterworth Heinemann, 2000.
4. H.M.Ryam, "High voltage Engineering and testing", 2nd Edition, 2001, IEEE power and energy series 32.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SEEX4009	POWER ELECTRONICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

List of Experiments

1. SCR Triggering Circuits
2. Commutation Circuits For SCR's
3. Single Phase Half & Fully Controlled Bridge Rectifier
4. Study Of SCR Parallel Inverter
5. Study Of SCR Series Inverter
6. AC Regulator-Phase Control Using DIAC & TRIAC
7. Study Of Cycloconverters
8. MOSFET Based Buck & Boost Converter
9. IGBT Based Single Phase PWM Inverter
10. Voltage Commutated Chopper
11. Current Commutated Chopper

S14XPROJ	PROJECT WORK & VIVA VOCE	L	T	P	Credits	Total Marks
		0	0	30	15	100

The objective of the project work is to make use of the knowledge gained by the student at various stages of the degree course. Students, will also be permitted to undertake industrial/consultancy project Work, outside the department, in industries/Research labs.

There shall be three assessments during the semester by a review committee. The student shall make three presentations on the progress made before the committee at various stages of the Project work. The Head of the Department shall constitute the review committee for each branch of study. The total marks obtained in the three reviews, shall be taken in to account. There will be a viva-voce examination at the end of the Project work, conducted by one internal examiner and one external examiner. The total marks secured will be the sum of marks secured in the Project reviews and Viva Voce Examination.

Each student is required to submit a Project report on the project assigned to him by the department. The report should be based on the information available in the literature or data obtained by the student by way of experiments conducted in the laboratory/industry.

SEEX1020	FLEXIBLE AC TRANSMISSION SYSTEM	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION**8 hrs.**

Electrical Transmission Network – Emerging Transmission Network – Concept of Reactive Power – Load and System Compensation – Midpoint Voltage – Passive Compensation – Synchronous Condenser – Saturated Reactor – Classification of FACTS controllers.

UNIT II SHUNT COMPENSATION**8 hrs.**

Thyristor Controlled Reactor (TCR) – Thyristor Switched Reactor (TSR) – Thyristor Switched Capacitor (TSC) – Fixed Capacitor- Thyristor Controlled Reactor (FC-TCR) – Thyristor Switched Capacitor-Thyristor Controlled Reactor (TSC -TCR) – V-I Characteristics of Static Var Compensator (SVC) – Advantages of slope in dynamic Characteristic – Voltage control by SVC.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC)**8 hrs.**

Fixed Series Compensation – Need for Variable Series Compensation – TCSC: Basic principle – Modes of Operation – Advantages – Analysis – Capability Characteristic – Variable Reactance Model – Application: Open loop & Closed loop Control.

UNIT IV EMERGING FACTS CONTROLLER**8 hrs.**

Static Synchronous Compensator (STATCOM): Introduction – Principle of Operation – V-I Characteristic. Multilevel VSC based STATCOM. Introduction to DSTATCOM. SSSC: Principle of Operation. Unified Power Flow Controller (UPFC): Principle of Operation. Interline Power Flow Controller (IPFC): Principle of Operation.

UNIT V SUB SYNCHRONOUS RESONANCE (SSR)**8 hrs.**

Concept of SSR – NGH-SSR Damping scheme: basic concept – design and operation aspect. Thyristor Controlled Braking Resistor (TCBR): Basic concept – design and operation aspect. Effect of SSR on rotor of the generator.

TEXT BOOKS:

1. R.Mohan Mathur and Rajiv K. Varma "Thyristor based FACTS controllers for electrical transmission systems", IEEE Press John Wiley & Sons Inc. Publication, 2002.
2. Narin G.Hingorani and Laszlo Gyugi "Understanding FACTS", IEEE Press Standard Publishers Distributors, 2001

REFERENCE BOOKS:

1. K.R.Padiyar "FACTS controllers in power transmission and distribution", New Age International Publishers, 2009.
2. M.Noroozian et.al, " Use of UPFC for optimal power flow control" Transactions on Power Delivery, Vol.12, No.4, oct 1997, pp 1629-1634
3. Gyugyi.L, 'Unified Power Flow Control Concept for Flexible AC Transmission", IEEE Proc-C Vol.139, N0.4, July 1992
4. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age International (P) Ltd., New Delhi, 2006.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SEEX1022	POWER SYSTEM OPERATION AND CONTROL	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION**8 hrs.**

System load variation: system load characteristics, load curves-daily, weekly and annual, load duration curve, load factor, diversity factor, Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, unit commitment, load dispatching. Overview of system control: Governor control, LFC, EDC, AVR, system voltage control, security control.

UNIT II ACTIVE POWER AND FREQUENCY CONTROL**8 hrs.**

Fundamentals of speed governing-control of generating unit power output-composite regulating characteristics of power systems-Response rates of turbine governing systems-Fundamentals of automatic generation control-Implementation of AGC-under frequency load shedding.

UNIT III REACTIVE POWER AND VOLTAGE CONTROL**8 hrs.**

Production and absorption of reactive power-Methods of voltage control-shunt reactors, shunt capacitors, series capacitors, synchronous condensers, static VAR systems-principles of transmission system compensation – Modeling of reactive compensation devices-Application of tap-changing transformers to transmission systems-Distribution System Voltage Regulation-Modeling of transformer ULTC control system.

UNIT IV COMMITMENT AND ECONOMIC LOAD DISPATCH**8 hrs.**

Statement of unit commitment (UC) problem-constraints in UC: Spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints-UC solution methods: priority-list methods, Forward dynamic programming approach, Lagrange Relaxation method. **Economic load dispatch:** incremental cost curves – equal incremental cost rule – loss coefficient – coordination equation.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS**8 hrs.**

Energy control system: Function-monitoring, data acquisition and control, system hardware configuration-SCADA and EMS function: Network topology determination, steady state estimate, security analysis and control. Various operating states: Normal, alert, emergency: Extremely emergency and restorative. state transition diagram showing various state transition and control strategies.

TEXT BOOKS:

1. P.Kundur, "Power system stability & control", Tata McGraw Hill publications, USA, 2006.
2. Allen. J.Wood and Brue F.Wollenberg, "Power generation, operation and control", John Wiley & sons, Inc, 2nd Edition, 2006
3. Olle.I.Elgerd, "Electric Energy Systems theory" – An Introduction, Tata Mc Graw Hill Publishing Company Ltd, NewDelhi, 2nd Edition, 2003.

REFERENCE BOOKS:

1. D. P. Kothari and I. J. Nagrath, "Modern power system analysis", 3rd Edition, Tata McGraw hill publishing company limited, NewDelhi, 2003.
2. Leonard L.Grigsby, "The Electric Power Engineering Handbook", CRC press & IEEE press, 2001.
3. L.L.Grigsby, " The Electric Power Engineering Handbook", CRC press & IEEE press, 2001.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

(Distribution may be 40% Theory & 60 % Numerical)

SECX1041	PROGRAMMING IN MATLAB (Common to ECE, ETCE, E&C and E&I)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I MATLAB ENVIRONMENT**8 hrs.**

Defining Variables – functions – Matrices and Vectors –Strings – Input and Output statements -Script files – Arrays in Mat lab – Addressing Arrays – Dynamic Array – Cell Array – Structure Array – File input and output – Opening & Closing – Writing & Reading data from files.

UNIT II PROGRAMMING IN MATLAB**8 hrs.**

Relational and logical operators – Control statements IF-END, IF-ELSE – END, ELSEIF, SWITCH CASE – FOR loop – While loop – Debugging – Applications to Simulation – miscellaneous MAT lab functions & Variables.

UNIT III PLOTTING IN MATLAB**8 hrs.**

Basic 2D plots – modifying line styles – markers and colors – grids – placing text on a plot – Various / Special Mat Lab 2D plot types – SEMILOGX – SEMILOGY – LOG- LOG – POLAR – COMET – Example frequency response of filter circuits.

UNIT IV APPLICATION OF MATLAB**8 hrs.**

Linear algebraic equations – elementary solution method – matrix method for linear equation – Cramer's method – Statistics, Histogram and probability – normal distribution – random number generation – Interpolation – Analytical solution to differential equations – Numerical methods for differential equations.

UNIT V TOOL BOXES**8 hrs.**

Simulink – Simulink model for a dead zone system, nonlinear system – Applications in DSP – Computation of DFT & FFT – Filter structure –IIR & FIR filter design – Applications in Communication PCM, DPCM, DM, DTMF- Interfacing of Matlab with event driven simulators.

TEXT BOOKS:

1. Rudra Pratap, Getting Started with MATLAB 6.0, 1st Edition, Oxford University Press, 2004.

REFERENCE BOOKS:

1. William J.Palm, Introduction to MATLAB 6.0 for Engineers, Mc Graw Hill & Co
2. M.Herniter, Programming in MATLAB, Thomson Learning.
3. John G.Proakis, Digital Signal Processing using MATLAB, Thomson Learning.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SICX1048	FUNDAMENTALS OF FUZZY LOGIC AND ARTIFICIAL NEURAL NETWORKS (Common to EIE, ECE, ETCE and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO FUZZY LOGIC**6 hrs.**

Introduction to Fuzzy Set Theory – Basic Concepts of Fuzzy Sets - Classical Set Vs Fuzzy Set – Properties of Fuzzy Set – Fuzzy Logic Operation on Fuzzy Sets – Fuzzy Logic Control Principles – Fuzzy Relations – Fuzzy Rules – Defuzzification.

UNIT II FUZZY LOGIC CONTROLLER & ITS APPLICATION**8 hrs.**

Fuzzy Logic Controller – Fuzzification Interface – Knowledge Base – Decision Making Logic – Defuzzification Interface – Application of Fuzzy Logic to Water Level Controller - Temperature Controller- Inverted Pendulum Control – Control of Blood Pressure during Anaesthesia.

UNIT III FUNDAMENTALS OF ANN**8 hrs.**

Fundamentals of ANN – Biological Neurons and Their Artificial Models – Types of ANN – Properties – Different Learning Rules – Types of Activation Functions – Training of ANN – Perceptron Model (Both Single & Multi Layer) – Training Algorithm – Problems Solving Using Learning Rules and Algorithms – Linear Separability Limitation and Its Over Comings

UNIT IV DETERMINISTIC & STATISTICAL NETWORKS**10 hrs.**

Back Propagation Training Algorithm – Practical Difficulties – Counter Propagation Network – Structure & Operation – Training of Kohonen and Grossberg Layer – Applications of BPN & CPN - Statistical Method – Training Application – Boltzman Training – Cauchy Training – Hop Field Network and Boltzman Machine – Speed Energy Function – Network Capacity –

Applications A / D Converter – Travelling Sales Man Problem – RBF Network

UNIT V BAM, ART & OPTICAL NETWORKS**8 hrs.**

BAM – Structure – Types – Encoding and Retrieving – Adaptive Resonance Theory – Architecture of ART 1 & ART 2 – Implementation – Training – Characteristics – Introduction to Optical Neural Network – Cognitron & Neocognitron

TEXT BOOKS:

1. Timothy Ross, Fuzzy logic with engineering application, McGraw Hill, Edition 1997.
2. James A. Freeman & Skapura, Neural Networks, Pearson Education, 2007.

REFERENCE BOOKS:

1. B.Yegnanarayana, "Artificial Neural Networks" Prentice Hall, September 2007.
2. Simon Haykin, "Artificial Neural Networks", 2nd Edition, Pearson Education.
3. Drankov, H.Hallendorn and M.Reinfrank, "An introduction to fuzzy control", Edition 2001.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max.Marks : 80

Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

80% theoretical and 10% numerical from Unit I & II, 10% from Unit III,IV, V may be asked

SCSX1017	DATA COMMUNICATION & COMPUTER NETWORKS (Common to CSE, IT and EEE)	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I PROTOCOLS & MEDIA**8 hrs.**

Introduction to data communication – Network protocols & standards – Line configuration – Topology – Transmission mode – Categories of networks – OSI model – Layers of OSI model – Transmission media – Guided media – Unguided media.

UNIT II SIGNALS & ERRORS**8 hrs.**

Analog and digital signals – Encoding and modulation – Parallel and serial transmission – DTE/DCE – Types of errors – Error detection and correction – Data link control – Line discipline – Flow control – Error control.

UNIT III MULTIPLEXING & SWITCHING**8 hrs.**

Multiplexing – Types of multiplexing – LAN – Project 802 – Ethernet – Token bus – Token ring – FDDI – MAN – IEEE 802.6 – Circuit switching – Packet switching.

UNIT IV ISDN & ATM**8 hrs.**

History of analog and digital network – Access to ISDN – ISDN layers – Broadband ISDN – Packet layer protocol – ATM – ATM architecture – ATM layers – Congestion control – Leaky bucket algorithm.

UNIT V NETWORK & APPLICATION LAYER**8 hrs.**

Repeaters – Bridges – Routers – Gateway – Routing algorithms – TCP/IP – Overview – Network layer – Transport and application layers of TCP/IP – DNS – SMTP – HTTP – WWW.

REFERENCE BOOKS:

1. Behrouz and Forouzan, "Data Communications and Networking", 2nd Edition, Tata McGraw Hill, 2007.
2. Andrew.S.Tenenbaum, "Computer Networks", PHI, 4th Edition.
3. William Stallings, "Data and Computer Communication", 6th Edition, Pearson Education, 2000.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 Hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks