VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

REVISED
SCHEME OF INSTRUCTION AND EXAMINATION W.E.F. 2017-2018 UNDER AUTONOMY

B.E 3rd Year - I – SEMESTER

S. NO	Sub reference Code	Subject	Scheme of Instructions				Scheme of Examination			
			Periods per week				Duration in Hrs	Maximum Marks		Credits
			L	T	D	P		SEM EXAM	Sessional	
THEORY										
1	EE 3010	Power System- II	3	2	-	-	3	70	30	4
2	EE 3020	Electrical Machinery - II	3	1	-	-	3	70	30	3
3	EE 3030	Power Electronics	3	2	-	-	3	70	30	4
4	EE 3040	Linear Integrated Circuits	3	1	-	-	3	70	30	3
5	EE 3050	Linear Control Systems	3	1	-	-	3	70	30	3
6	HS 3110	Finishing School – Soft Skills	1	1	-	-	1.5	35	15	1
7	EE 3110	Finishing School – Technical Skills	1	1	-	-	1.5	35	15	1
PRACTICALS										
8	EE 3031	Electrical Machines-I Lab	-	-	-	2	3	50	25	1
9	EE 3041	Control System Lab	-	-	-	2	3	50	25	1
10	EE 3051	Mini Project	-	-	-	2	viva-voce	-	25	1
		TOTAL	**17**	**9**		**6**		**520**	**255**	**22**
		Grand Total	**32**					**775**		

*** BOS Members may kindly permit us:**

1. For any modification of subject code in future.
2. To change the lecture period from 50 minutes to 1 hour.
3. To change the Credits for Labs from 2 to 1 and to reduce lab periods from 3 to 2.
4. To change the Tutorials for PS – II & Power Electronics from 1 to 2 and Credits from 3 to
5. To change the finishing school lectures from 2 to 1.

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SCHEME OF INSTRUCTION AND EXAMINATION W.E.F. 2017-2018 UNDER AUTONOMY

B.E 3rd Year - II – SEMESTER

S. NO	Sub reference Code	Subject	Scheme of Instructions				Scheme of Examination			
			Periods per week				Duration in Hrs	Maximum Marks		Credits
			L	T	D	P		SEE	CIE	
THEORY										
1	EE 3060	Digital Signal Processing	3	1	-	-	3	70	30	3
2	EE 3070	Electrical Machinery – III	3	2	-	-	3	70	30	4
3	EE 3080	Switchgear and Protection	3	1	-	-	3	70	30	3
4	EE 3090	Microprocessors and Microcontrollers	3	1	-	-	3	70	30	3
5	EE 3100	Electric Drives and Static Control	3	1	-	-	3	70	30	3
6	HS 3210	Finishing School – Soft Skills	1	1	-	-	1.5	35	15	1
7		Finishing School – Technical Skills	1	1			1.5	35	15	1
8	HS 3140	Human Values and Professional Ethics – II	1	-		-	3	70	30	1
PRACTICALS										
9	EE 3061	Electrical Machines – II Lab	-	-	-	2	3	50	25	1
10	EE 3071	Power Electronics Lab	-	-	-	2	3	50	25	1
11	EE 3081	Integrated Circuits Lab	-	-	-	2	3	50	25	1
		TOTAL	**18**	**8**	**-**	**6**		**640**	**285**	**22**
		Grand Total	**32**					**925**		

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1. For any modification of subject code in future.
2. To change the lecture period from 50 minutes to 1 hour.
3. To change the Credits for Labs from 2 to 1 and to reduce lab periods from 3 to 2.
4. To change the Tutorials for EM – III from 1 to 2 and Credits from 3 to 4.
5. To change the finishing school lectures from 2 to 1.

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BE 3/4 EEE
I – Semester
2016-17

EE 3010 Power System- II

Instruction	3 Periods + 2 Tutorial Period per week
Duration of Final Examination	3 Hours
Final Examination	70 Marks
Sessional	30 Marks
Credits	4

Course objective:	Course Outcomes:
Enable the student to 1. Acquire knowledge of Transmission Lines Performance, Power circle diagrams & Corona. 2. Understand the Per Unit system of Representation, load flow studies and different load flow methods. 3. Learn about the Symmetrical Fault analysis and S.C capacity of a Bus. 4. Acquire the knowledge of the fundamentals of Sequence components, Sequence networks of Generator, T/F, T.M.L & Load and Unsymmetrical Fault analysis of power system. 5. Understand the concept of Travelling Wave theory and Bewley Lattice diagram.	1. Able to **calculate** and **compare** the performance (Constants A, B, C & D, voltage regulation & efficiency) of different types of Transmission lines. 2. Able to **differentiate** and **choose** the proper load flow method for solution of load flow problems. 3. Student can **calculate** the P.U quantities in power system and **analyze** symmetrical fault (LLL-Fault) and **calculate** S.C capacity of a Bus. 4. Able to draw the **diagram** of Sequence networks of different components and **calculate** the Unsymmetrical Fault (LG, LL, LLG & LLLG) current value & MVA values. 5. Student can **evaluate** the value of coefficient of reflection and refraction of voltage or current wave and **construct** Bewley Lattice diagram.

UNIT-I

Transmission Line Theory: Short, medium, long lines – Line calculations, Tuned lines – Power circular diagrams and their applications. Corona : Causes – Disruptive and Visual Critical Voltages, Power loss – minimization of Corona Effects.

UNIT-II

Per Unit system of Representation : Use of per Unit Quantities in power systems, Advantages of per unit system.

Load flow studies: Formation of Y bus for a system, modeling of tap changing and phase shifting transformer, formulation of load flow problem, Solution of load flow by Gauss-Seidel, Newton-Raphson, Decoupled and fast Decoupled methods, comparison of different load flow methods.

UNIT-III

Z-bus formation - Symmetrical Three phase Transients in R-L series circuits – short circuit currents – Reactances of Synchronous Machines – Symmetrical Fault calculations. short circuit capacity of a bus.

UNIT-IV

Unsymmetrical faults : Symmetrical components of unsymmetrical phasors – Power in terms of symmetrical components - sequence impedance and sequence networks. Sequence networks of unloaded generators – Sequence impedances of circuit elements – Single line to ground, line-to-line and double line to ground faults on unloaded generator – Unsymmetrical faults of power systems.

UNIT-V

Transients in power systems : Causes of over voltages : Traveling Wave Theory – Wave equation – Open Circuited Line – The short circuited line – Junction of lines of different natural impedances – Reflection and refraction – Coefficients – Junction of Cable and overhead lines – Junction of three lines of different natural impedances – Bewley Lattice diagram.

Suggested Reading:

1. C.L. Wadhwa , Electrical Power Systems, Wiley Eastern Ltd., 4th Ed. 2006.
2. John J.Grainger William D. Stevenson Jr. Power System Analysis, Tata MCGraw Hill Edn.2003
3. I.J.Nagrath & D.P.Kothari "Modern Power Systems Analysis" TMH Edition, 2003.
4. A. Chakrabarti, M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A Text book on Power System, Dhanpat Rai & Co(P) Ltd.
5. Chakravarthy, Power System Operation and Control.

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EE 3020 ELECTRICAL MACHINERY – II

Instruction	3 Periods + 1 Tutorial Period per week
Duration of Final Examination	3 Hours
Final Examination	70 Marks
Sessional	30 Marks
Credits	3

Course objective:	Course Outcomes:
The aim of this course is: 1. To study the parallel operation of single phase transformers and analyze the behaviour for different conditions. 2. To provide an understanding of different connections and phase conversions of three phase transformer and analyze their behaviour. 3. To explain the principle of operation of three phase induction motor and their operating characteristics and analyze the performance with the equivalent circuit parameters. 4. To contrast different methods of speed control of three phase induction motor and analyze their slip-torque characteristics. 5. To analyze the behaviour of three phase induction motor under unbalanced operation.	The student will be able to: 1. Demonstrate the effective single phase parallel operation and calculate the load shared by each transformer. 2. Identify suitable connection of three phase transformer for different applications. 3. Select suitable three phase induction motor for different applications and also calculate efficiency in the design stage. 4. Interpret the suitable speed control method of three phase induction motor for different applications. 5. Explain the adverse effects of three phase induction motor and three phase transformer under unbalanced operation.

UNIT-I:

Parallel operation of Single phase Transformer and load sharing. Insulation of windings and terminals. Cooling arrangement in Transformers. Testing of Transformers – Routine Tests, and special tests – Measurement of winding resistance. Measurement of voltage ratio and check for voltage – vector relationship. Measurement of No load loss and current. Measurement of insulation resistance. Maintenance of Transformers.

UNIT-II:

Three-phase Transformer – Connections, Choice of Transformer Connections, **Excitation phenomena of transformers** Third harmonic voltages – Phase conversion – 3 phase to 2 phase transformation – Scott connection. Constructional features of three-phase transformer, tertiary winding, parallel operation of transformer, Auto Transformer – Comparison with two winding transformers – Conversion of two winding transformer to auto transformer.

UNIT-III:

Three-phase Induction Motor – Constructional features – Rotating magnetic field theory – Principle of operation of squirrel cage and slip ring motors – Vector diagram, Equivalent circuit – Expression for torque – Starting torque, Maximum torque – Slip/Torque

characteristics – Performance characteristics – Equivalent circuits from test – Current loci circle diagram – Predetermination of characteristics of induction motors.

UNIT-IV:

Starting methods of induction motor. Modes of operation. –Torque and power limits of Induction motors. Speed control methods – Resistance control, Voltage control, Pole changing, Cascading, Variable frequency control. Slip power recovery schemes – Kramer drive, Scherbius drive. Double cage inductor motors. Induction generator.

UNIT-V:

Unbalanced Operation: Voltage unbalance – Unbalanced operation of 3-phase induction motor – Per phase equivalent circuits – Single phasing – Unbalance operation of 3-phase transformers – Single phase load on three phase transformers – Single Phasing in 3 phase transformers – Delta/Star and Star/Delta transformers.

Suggested Reading:

1. I.J. Nagarath, D.p.Kothari, Electrical Machines. 4th Edition Tata McGraw Hill, 2010.
2. J.B. Gupta, Theory and Performance of Electrical Machines, S.K. Kataria. & Sons, 2003.
3. M.G. Say, The Performance and design of A.C. Machines – Pitman.
4. Electrical Machinery, Dr.P.S Bimbhra.

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EE 3030 POWER ELECTRONICS

Instruction	3 Periods + 2 Tutorial Period per week
Duration of Final Examination	3 Hours
Final Examination	70 Marks
Sessional	30 Marks
Credits	4

Course objective:	Course Outcomes:
1. To provide fundamentals of power semi – conductor devices and its applications in power electronics. 2. To impart the knowledge of turn – on and turn – off of various power semi – conductor switches. 3. To understand the operation and application of various power converters in power electronics. 4. To impart the knowledge of control techniques employed for switches in different types of converters.	A successful graduate will be able to 1. Categorize and compare various devices used in power electronics. 2. Analyze and select the appropriate converter for a given application. 3. Suggest suitable commutation, protection and control circuits for a given application. **4.** Design power and control circuits for the required application with given specifications.

UNIT-I

Power Semiconductor Devices: Power diode, types of power diodes - general purpose diodes, fast recovery diodes and Schottky diodes, their Characteristics, Basic structure, working, steady state and switching characteristics of BJT, Power MOSFETs, IGBTs, SCRs and GTOs, two transistor analogy of SCR, comparison of BJT, MOSFET and IGBT, applications of power semi – conductor devices.

UNIT-II

Firing, Driver and Protection circuits: R, RC and UJT triggering circuits for SCR, triggering circuits for single phase bridge rectifier and choppers, driver circuits for MOSFET, IGBT and BJT, commutation methods of SCRs, protection of SCRs.

UNIT-III

AC – DC Converters: Principles of controlled rectification - study of 1 – φ and 3 – φ half and full controlled bridge rectifiers with R, R – L, R – L – E loads, effect of source inductances, dual converters - circulating current mode and circulating current free mode – control strategies.

UNIT-IV

DC – DC, DC to AC and Cyclo Converters: Classification of choppers – A, B, C, D and E, switching mode regulators – study of Buck, Boost and Buck-Boost regulators, Cuk regulators, single phase AC voltage controllers with R & RL loads, principle of operation of 1 – φ bridge type cyclo converters & their applications.

UNIT-V

Inverters: Principle of operation of 1 – φ inverter, 3 – φ bridge inverters (180° and 120° modes), voltage control of inverters - single pulse width modulation, multiple pulse width modulation and sinusoidal pulse width modulation, comparison of voltage source inverters and current source inverters, elementary multilevel inverters.

Suggested Reading:

1.Singh, M.D and Khanchandani, K.B, – *Power Electronics*, Tata McGraw Hill, 2nd Edition, 2006.

2.Rashid, M.H – *Power Electronics: Devices, Circuits and Applications*. Pearson, 2003

3.Mohan, Undeland, Robbins, *Power Electronics – Converters, Applications and Design*, Wiley India Pvt Ltd, 2010.

4.Bimbra.P.S, *Power Electronics*, Third Edition, Khanna Publishers, 2012.

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EE 3040 LINEAR INTEGRATED CIRCUITS

Instruction	3 Periods + 1 Tutorial Period per week
Duration of Final Examination	3 Hours
Final Examination	70 Marks
Sessional	30 Marks
Credits	3

Course objective:	Course Outcomes:
To impart fundamental concepts of linear and non linear devices and circuits namely Operational Amplifier, Multivibrator, 555 timer, ADC, DAC conversion methods, voltage regulators and provide an overview on design of second order Filters for Linear IC applications.	1. Demonstrate an understanding of fundamentals of linear integrated circuits. 2. Analyze the various applications and circuits based on particular linear integrated circuit. 3. Select and use an appropriate linear integrated circuit to build a given application. 4. Analyze the non-linear circuit applications and design voltage regulators. Design an application with the use of linear integrated circuit.

UNIT-I

Operation amaplifiers-Characteristics, open loop voltage gain, output impedance, input impedance, common mode rejection ratio – Offset balancing techniques – Slew rate, Frequency response - Stability, frequency compensation of Op-amp ,basic applications – Inverter summer, analog integrator, differentiator, current to voltage converter, voltage to current converter, log -anti log amplifier, voltage follower, ac amplifier.

UNIT-II

Voltage limiter, clipper and clamper, precision rectifier- full wave and half wave , peak detector, comparator, zero crossing detector, Schmitt trigger, monostable , astable , bistable, multiplier, divider, difference amplifier, Instrumentation amplifier circuits using Op-amps.

UNIT-III

Waveform generation using op-amps-sine, Square, Triangular, Quadrature oscillators ,voltage controlled oscillator/multi vibrator, voltage to frequency converter , 555 timer functional diagram, operation as monostable and astable. phase locked loop, A/D and D/A converters.

UNIT-IV

Series voltage regulator, shunt regulators, and switching regulators using OP-amp, dual voltage regulator, fixed voltage regulators, dual tracking regulators, current sensing and current feed back protection.

UNIT-V

RC active filters-low pass,high pass and band pass, band reject, notch, first order, second order transformation , state variable filter , switched capacitor filter , universal filter, Balanced modulator and demodulator

Suggested Reading:

1. D.Roy Choudhury, Linear Integrated Circuits, Shail B.Jain, 4th Edition, New Age International(P) Ltd., 2010.
2. R.A. Gayakwad, Op-Amps and Linear Integrated Circuits, 4th Edition, Prentice Hall of India, 2009.
3. Coughlin and Driscoll, Operational Amplifiers and Linear Integrated Circuits, 6th Edition, Prentice hall of India, 2003.
4. Malvino Albert Paul, Electronic Principles, 7th Edition, Tata McGraw Hill, 2006.
5. S. Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw Hill Inc., 2002

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EE 3050 LINEAR CONTROL SYSTEMS

Instruction	3 Periods + 1Tutorial Period per week
Duration of Final Examination	3 Hours
Final Examination	70 Marks
Sessional	30 Marks
Credits	3

Course objective:	Course Outcomes:
Study the principles of system modeling, system analysis and feedback control, and use them to design and evaluate feedback control systems with desired performance; specifically, to acquire the related knowledge and techniques to meet the following course objectives: 1. *Control system modeling*: modeling of electric, mechanical and electromechanical systems, using differential equations, transfer functions, block diagrams, and state variables; 2. *Control system analysis*: analysis of properties of control systems, such as sensitivity, stability, controllability, tracking, in time and frequency domains; and 3. *Control system design*: design of feedback controllers, such as PID, lead and lag compen- sators, pole placement designs, to meet desired system performance specifications.	1. To model the electrical, mechanical and electromechanical systems using differential equations, transfer functions, block diagrams and state variables 2. To obtain the time and frequency response of systems and analyse them with respect to performance specifications 3. To analyze the stability, controllability and observability in time and frequency domains 4. To design the feedback controllers, such as PID, lead and lag compensators to meet the desired performance specifications 5. To analyze the stability, controllability and observability of digital control systems

UNIT – I

Open and Closed loop Systems**,** Continuous time and discrete time control systems, Control System components – Error sensing devices – Potentiometers. Synchros, AC – DC servo motors – Block diagram representation, Transfer function and impulse response – Signal flow graphs.

UNIT – II

Time Response: Types of Input, Transient response of second order system for step input. Time domain specifications – Types of system – static error coefficients, Error series – Routh-Hurwitz criterion of stability. Root Locus Technique – Typical systems analyzed by root locus technique – Effect of location of roots on system response, PID controller.

UNIT – III

Frequency Response Plots: Bode Plots, Frequency domain specifications. MP, wP for a second order system, Nyquist criterion for a stability, relative stability gain and phase margin, Compensation: Cascade compensation Using Bode Plots.

UNIT – IV

State Space Representation: Concept of state, State Variable, State Models of linear time invariant systems. Derivation for state models from transfer functions and differential equations. State transition matrix – solution of state equations by time domain method. Observability and controllability.

UNIT – V

Discrete Control Analysis: Introduction to signals and systems, the Z – transformation, digital control, advantages and disadvantages. Digital Control System Architecture. The discrete transfer function. Sample data system. Transfer function of sample data system – Z – Plane specifications of control system design. Z – domain stability.

Suggested Readings:

1. I.J. Nagrath, M. Gopal, Control System Engineering< new Age International (P) Limited publishers, 2007.
2. J. F. Franklin and J.D. Powell – Digital Control of Dynamic Systems, Addison Wesley.
3. M. Gopal, Control System Principles and Design – Tata Mc Graw Hill, 2nd edition, 2003.
4. K. Ogata, Modern Control Systems, 3rd Edition, PHI.

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EE 3110 FINISHING SCHOOL – TECHNICAL SKILLS

Syllabus for B.E 3/4 I-SEMESTER

Instruction	2 Per Week
Final Examination	35 Marks
Sessional	15 Marks
Credits	1

Course objective:	Course Outcomes:
The course will enable the students to: The objective of the course is to explain efficient storage mechanisms for an easy access and design and implement various data structures and improve logical ability.	**At the end of the course student will be able to:** 1. The student will be able to identify different Object Oriented Concepts , define Algorithm , analyse the algorithm with different asymptotic notations ,Abstract data type 2. The student will be able describe Stack and Queue , the different operations on stack and queue , their applications . 3. The student will be able distinguish between arrays and Linked list , implement different operations performed on stacks and queues using linked list. 4. The student will be able to demonstrate and create different trees, operations on trees . 5. The student will be able to demonstrate and create different trees, operations on graphs and different sorting techniques

UNIT-I

Algorithm Specification, Performance Analysis and Measurement.

C++ Review, Abstract Data Types and the C++ Class, Array as an Abstract Data Type, Polynomial Abstract Data Type, Representation of Arrays, String Abstract Data Type.

UNIT-II

Stacks and Queues: Templates in C++, Stack Abstract Data Type, Queue Abstract Data type, Applications of Stacks and Queues.

UNIT-III

Linked Lists: Singly Linked Lists , Doubly Linked Lists. Linked Stacks and Queues, Polynomials

Applications of Linked Lists.

UNIT-IV

Trees: Introduction, Binary Trees, Binary Tree Traversal ,Binary Search Trees.

Binary Search Trees: AVL Trees, Red-Black Trees, Splay Trees, m-way Search Trees, B-Trees.

UNIT-V

Graphs: Graph Abstract Data Type, Elementary Graph operations (dfs and bfs), Minimum Cost Spanning Trees

Sorting: Insertion sort, Quick sort, Merge sort, Heap sort.

Suggested Reading:

1. Ellis Horowitz, Dinesh Mehta, S. Sahani. Fundamentals of Data Structures in C++, Universities Press. 2007.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education 2006.

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EE 3031 - ELECTRICAL MACHINES LAB - I

Instruction	2 Periods per week
Duration of Final Examination	3 Hours
Final Examination	50 Marks
Sessional	25 Marks
Credits	1

Course objective:	Course Outcomes:
To expose the students to practical experiments of DC machines and single phase transformers.	1. Able to test the performance of various DC generators. 2. Able to test the performance of various DC motors. 3. Able to test the performance of single phase transformers.

List of Experiments:

1. Magnetization characteristics and the speed Vs voltage curve of separately and self excited D.C. generator
2. Load characteristics of D.C Shunt Generators
3. Load characteristics of D.C Compound generator
4. Performance characteristics of D.C Series Motor
5. Performance characteristics of D.C. shunt motor
6. Performance characteristics of D.C Compound motor
7. Separation of iron and friction losses and estimation of parameters in D.C. machines.
8. (a)Speed control of D.C. shunt motor by shunt field control and armature resistance control (b) Swinburn's Test
9. Separation of core losses in a Single Phase transformer
10. Open circuit and short circuit tests on a Single Phase transformer
11. Sumpner's test on two identical transformers
12. Estimation of efficiency of DC Machine by Hopkinson test.
13. Retardation Test , Dynamic Braking of DC Shunt Motors.

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EE 3041 - CONTROL SYSTEM LABORATORY

Instruction	2 Periods per week
Duration of Final Examination	3 Hours
Final Examination	50 Marks
Sessional	25 Marks
Credits	1

Course objective:	Course Outcomes:
The objective of the lab is to provide an experience in working with various control system components and control systems for understanding analyzing them and also enhance the analyzing capability by introducing simulation tools for control systems.	A successful graduate will be able to 1. Obtain the characteristics of AC, DC servo motors and synchro pair 2. Obtain the characteristics of second order system and analyze the time domain specifications. 3. Understand AC and DC position control systems and analyze them. 4. Obtain the frequency response characteristics and design lead and lag compensators.

LIST OF EXPERIMENTS:

1. Characteristics of DC and AC Servo motors.
2. Characteristics of Synchro Pair .
3. Frequency response of compensating networks.
4. Step response of second order system.
5. DC position control system.
6. AC position control system.
7. Closed loop P, PI and PDI controller.
8. Step response and frequency response of a given plant.
9. Design of lag and lead compensation for the given plant.
10. ON/ OFF Temperature control system.
11. Temperature control system.
12. Level Control System.

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EE 3051 – MINI PROJECT

Instruction	2 Periods per week
Duration of Final Examination	3 Hours
Sessional	25 Marks
Credits	1

Course objective:	Course Outcomes:
The mini project is by far the most important part in the degree program. It provides an opportunity for students to demonstrate independence and originality, to plan and organise a large project over a long period, and to put into practice some of the techniques students have been taught throughout the course. It enables the students to acquire confidence at having conceptualized, designed, and implemented a working, medium sized project with their team .	1. Apply the knowledge acquired in the electrical engineering. 2. Demonstrate the ability to locate and use technical information from multiple sources. 3. Demonstrate the ability to communicate effectively through a technical report. 4. Demonstrate independent learning and professional ethics. 5. Demonstrate the project management capabilities. .

List of Experiments:

1. Design and winding of a two winding transformer.
2. Design and winding of a 3-phase Induction Motor.
3. Design and winding of a single phase capacitor start induction motor.
4. Design of a voltage stabilizer.
5. Design of choke.
6. Disassembly, repairing, assembly and testing of electrical devices.
7. Design of a inverter
8. Design and winding of a 3 winding transformer
9. Design and winding of a stepper motor
10. Designing of relay coils for different PSM and TSM

Note:

- Students should choose any two from the above, execute and demonstrate.
- Students can also come out with innovative projects and after approval by the faculty; they should execute and demonstrate the project.

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BE 3/4 EEE
II – Semester
2016-17

EE 3060 Digital Signal Processing

Instruction	3 Periods + 1 Tutorial Period per week
Duration of Final Examination	3 Hours
Final Examination	70 Marks
Sessional	30 Marks
Credits	3

Course objective:	Course Outcomes:
This course will introduce the basic concepts and techniques for processing digital signals. By the end of the course, students will be familiar with the most important methods used in DSP applications, including digital filter design, transform-domain processing and importance of Signal Processors. The course emphasizes intuitive understanding and practical implementations of the theoretical concepts.	After completing the course the student will be able to: 1. Understand the basics and significance of Digital Signal Processing and its applications. 2. Analyze the digital systems using Discrete Fourier Transforms and Fast Fourier transforms. 3. Apply Z transforms to digital systems and realize digital filters. 4. Design IIR filter using Butterworth or Chebychev analog filters and then transform them to digital filters. 5. Design FIR filters using various window techniques. Also understand the basic architecture of DSP processor.

UNIT–I:

Introduction to Digital Signal Processing: Classification of signals & Systems-properties of Discrete system- Linear shift-invariant systems, stability and causality, Sampling of Continuous Signals - Signal Reconstruction, quantizing & encoding, Linear constant co-efficient difference equations. Applications of DSP.

UNIT-II:

Fourier Analysis: Discrete Fourier series, Discrete Fourier transform, Phase and amplitude spectra, Properties of Discrete Fourier Transform. Linear convolution of sequence using DFT, Circular convolution overlap save method and overlap add method- Fast Fourier Transform- Radix-2 decimitation-in- time and decimitation-in-frequency FFT algorithms, Inverse FFT.

UNIT-III:

Z-Transform.: Properties of z transform, Applications of z-transforms for solution of difference equations of digital filters system function, stability criterion, Realization of filters – direct, canonic. Cascade and parallel form.

UNIT-IV:

Introduction to digital filters-types of filters-IIR Filters- Design of Butterworth, chebyshev filters, IIR filter design by impulse invariance and bilinear transformation.

FIR Filters: Design and Characteristics of FIR Digital Filters. Frequency response, Window Techniques– Rectangular window, Harming window, Bartlet window, Kaiser window.

UNIT- V:

Introduction to TMS320LF2407 DSP Controller: Basic architecture features – physical memory – software tools.

General Purpose Input Output (GPIO): Pin multiplexing and general purpose I/O overview – Multiplexing – General purpose I/O control registers.

SUGGESTED READINGS:

1. Digital Signal Processing: Principles, Algorithms, and Applications by John G Proakis, 4th Edition 2007
2. P. Venkata Ramani, Bhaskar," Digital Signal Processor, Architecture, Programming & Application", TataMcGrawHill-2004
3. Avtar Singh,S.Srinivasan, "Digital Signal Processing", Thomson Publications, 2004.
4. Hamid A. Tolyat "DSP based electro mechanical motion control, CRC Press 2003
5. Oppenheim AV, and Schafer R.W.Digtal Signal Processing – Prentice Hall Inc.1975.

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EE 3070 ELECTRICAL MACHINERY – III

Instruction	3 Periods + 2 Tutorial Period per week
Duration of Final Examination	3 Hours
Final Examination	70 Marks
Sessional	30 Marks
Credits	4

Course objective:	Course Outcomes:
The aim of this course is: **1.** To describe an overview of constructional details and types of windings of synchronous machine, **2.** To contrast different methods of finding voltage regulation of synchronous generator. **3.** To explain the principle of operation of synchronous motor, starting methods and analyze their performance characteristics **4.** To analyze the transient stability of synchronous machine connected to infinite Bus. **5.** To discuss different single phase motors, special motors and analyze their performance characteristics.	The student will be able to: **1.** Distinguish various parts and types of windings of synchronous machine **2.** Identify suitable method to find voltage regulation and also calculate the regulation of Synchronous generator. **3.** Demonstrate the principle of operation of synchronous motor and their operating characteristics. **4.** Explain transient behaviour and stability of synchronous machine connected to infinite Bus. 5. Choose suitable single phase induction motor for various applications.

UNIT–I:

Synchronous Machines**:** Constructional details, Types of windings – Winding factors – e.m.f. equation – Fractional pitch and fractional slot windings – Suppression of harmonics and tooth ripple – Armature reaction and reactance – Synchronous impedance.

UNIT-II:

Synchronous Generator: Voltage regulation – Phasor diagram of alternator with non-salient poles – O.C. and S.C. characteristics – Synchronous impedance, Ampere turn, ZPF methods for finding voltage regulation – Principle of two reaction theory and its application for the salient pole synchronous machine analysis – Synchronizing and parallel operation.

UNIT-III:

Synchronous Motor: Theory of operation – Vector diagram – Variation of current and p.f. with excitation – Hunting and its prevention – Power angle characteristics – Slip test – Current and power diagram –Predetermination of performance-Methods of starting and synchronizing. Synchronizing power .Synchronous condenser.

UNIT-IV:

Transient Stability Studies of Synchronous Machines: Elementary ideas of transient behaviour of an alternator – Three phase short circuit of an alternator - Elementary ideas of the stability of synchronous machine connected to infinite Bus. Special machines - Permanent magnet motors, Switched reluctance motors, Hysteresis motors.

UNIT- V:

Two phase servo motor characteristics – Single phase motors – Theory and operation of single phase motors – Shaded pole, Split phase and capacitor motors – Compensated and uncompensated series and repulsion motors. Linear induction motors.

Suggested Reading:

1. M.G. Say, The Performance and Design of A.C. Machines – Pitman Publications.
2. I.J. Nagrath & D.P. Kothari, Electrical Machines, Tata McGraw Hill.
3. P.S. Bhimbra, Generalized Theory of Electrical Machines, Khanna Publications.
4. Electrical Machinery, Dr.P.S Bimbhra.

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EE 3080 SWITCHGEAR AND PROTECTION

Instruction	3 Periods + 1 Tutorial Period per week
Duration of Final Examination	3 Hours
Final Examination	70 Marks
Sessional	30 Marks
Credits	3

Course objective:	Course Outcomes:
	At the end of the course the student will be able to:
1. To analyze principles of operation of the different types of electromagnetic relays.	1. calculate parameters of relay operations, analyze the principles of operation of various electromagnetic relays, derive the characteristics and apply for protection of transmission lines.
2. To comprehend principles and operation of static, microprocessor and distance relays.	2. analyze the characteristics of dual input comparators, static relays and microprocessor based relays and distance relays.
3. To comprehend the different principles of protective schemes in power system and power apparatus.	3. apply the knowledge of different principles of relays for equipment protection like alternators, transformers, bus bars etc.
4. To comprehend the principles of operation of the different types of circuit breakers.	4. comprehend, analyze the concepts of circuit interruption and perform calculations on restriking voltage, recovery voltage, RRRV etc.
5. To be acquainted with different lightning arrestors for the protection of the various equipments of power system.	5. comprehend Analyze and apply the knowledge of different types of lightning arrestors, surge absorbers and design of ground wire, insulation coordination for various over voltage applications.

UNIT – I

Introduction to protective relays: Need for protection – primary protection – backup protection – zones of protection – Definitions of relays pickup, Dropout and reset values, Classification of relays, operating principles and construction of Electromagnetic and induction relays, Over current, Over voltage and Power relays. Directional features – Universal relay torque equation. Over current protection for radial feeders and ring mains, Protection of parallel lines, Relay settings for over current relays, Earth fault and phase fault protection.

UNIT – II

Static phase and Amplitude comparators: Characteristics of dual input comparators. Distance protection – 3 steps distance relays, Characteristics of distance relays on RX Diagram – Static over current relay, Microprocessor based over current relaying (block diagram), need for numerical relays, advantages and functional block diagram of numerical relay.

UNIT – III

Transformer and generator protection: Differential relays – percentage differential relays – protection of generator and transformer using percentage differential relays – split phase, interturn protection, overheating, loss of excitation, protection of generators – Protection of transformers against magnetizing in rush – Bucholz relays – Protection of earthing transformers – Generator transformer unit protection.

UNIT – IV

Circuit breakers: Need for circuit breakers – arc properties – principles of are quenching, Theorics, Recovery and restriking voltages, Definitions in Circuit breakers, rated symmetrical and asymmetrical breaking current – rated making current – rated capacity, voltage and frequency of circuit breakers , Auto reclosure, Duty cycle, Current chopping – resistance switching – derivations of RRRV – Maximum RRRV etc., Circuit breaker calculations – types of circuit breakers – Bulk oil, Minimum oil, air, air blast, SF6 and vacuum circuit breakers, testing of circuit breakers.

UNIT – V

Over voltage protection: Protection of transmission lines against direct lightening strokes – ground wires – protection angle – protection zones – height of ground wire – conductor clearances – conductor heights – tower footing resistance and its effects – Equipment protection assuming rod gaps, arcing horns, different types of lightening arrestors – their construction – surge absorbers – Peterson coil – insulation co-ordination.

Suggested Reading:

1. Badriram, Viswakarma, Power System Protection and Switchgear, Tata McGraw Hill, 2011.
2. C.L. Wadhwa, Electrical Power system, Wiley Eastern Ltd. 2nd Edition, 2010.
3. Sunil S.Rao, Switchgear and Protection, Khanna Publications.
4. B. Ravindranath & M.Chander, Power Systems Protection & Switchgear, New Age International, Special Indian Edition.

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EE 3090 MICROPROCESSORS AND MICROCONTROLLERS

Instruction	3 Periods + 1 Tutorial Period per week
Duration of Final Examination	3 Hours
Final Examination	70 Marks
Sessional	30 Marks
Credits	3

Course objective:	Course Outcomes:
1. To understand the architecture, operation, and addressing modes of Intel 8086 microprocessor and 8051 Microcontroller. 2. To Study the instruction set and programming of 8086MP and 8051 MC. 3. To understand memory interfacing and various interfacing circuits for various applications.	Will be able to 1. Describe the architecture of 8086 microprocessor and 8051 Microcontroller. 2. Identify and analyze different types of addressing modes and instruction set of 8086 MP and 8051 MC. 3. Write assembly language programs for various applications using instructions and assembler directives of 8086 MP and using instructions of 8051 MC. 4.Compare and contrast macros with subroutines. 5.Interface the microprocessor and microcontroller with memory and I/O devices. And Configure, program and deal with software and hardware interrupts.

UNIT - I

Over view of micro computer structure and operation - Microprocessor Architecture of 8086- Segmented memory, Addressing modes, Instruction set, Minimum and Maximum mode operations.

UNIT-II

Construction of machine codes for MOVE 8086 instruction - Assembly language Programming, Assembler directives, simple programs using Assembler, strings, procedures, Macros, timing.

UNIT- III

Memory and I/O interfacing, A/D and D/A interfacing, 8255 (PPI), programmable Interval Timer (8253), Keyboard and display interface, interrupts of 8086, Seven segment display, 8257 DMA controller, 8251 USART

UNIT - IV

Microcontrollers - 8051 microcontroller, Architecture, I/O ports, connecting external memory, Instruction set, Assembly language programming.

UNIT - V

Interrupts programming concepts with examples, Serial communication programming concepts with examples, Timers, Counters, Applications of micro controllers interfacing LEDs, Seven Segment display, Keyboard Interfacing, LCD interfacing, Stepper motor interfacing.

Suggested Reading:

1. Douglas.V.Hall-Microprocessors and Interfacing-Rara Mcgraw Hill-Revised 2nd edition, 2006.
2. Krishna Kant – Microprocessors and Microcontrollers – Architecture, Programming and System Design 8085, 8086 8051, 80996, Prentice-Hall India-2007.
3. Kenneth.J.Ayala _ "the 8051 , Microprocessors Architecture , Programming and Application, Thomson publishers, 2nd edition.
4. Walter A. TRiebel & Avatar Singh- The 8088 and 8086 Microprocessor – Fourth Edition, pearson

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EE 3100 ELECTRIC DRIVES AND STATIC CONTROL

Instruction	3 Periods + 1 Tutorial Period per week
Duration of Final Examination	3 Hours
Final Examination	70 Marks
Sessional	30 Marks
Credits	3

Course objective:	Course Outcomes:
• To introduce the principle and working of speed control of DC motor by using single phase full controlled and half controlled rectifier. • To familiarize the students with the Four-quadrant operation of DC motor and Electric braking. • To develop and understanding of various Chopper controlled DC drives. • To familiarize the students with the speed control of Induction motor from stator and rotor side. • To develop and understanding the principle of speed control of Synchronous motor, BLDC and SRM.	• Modify the speed torque characteristics of DC and Induction motors • Apply Electric braking techniques to DC and Induction Machines • Select an appropriate speed control for DC motor drive to meet the requirements of application in Industry. • Choose an appropriate speed control for Induction motor drive to meet the requirements of application in Industry. • Select an appropriate speed control for Synchronous motor, BLDC and SRM drive to meet the requirements of application in Industry.

UNIT-I

Electric Drives: Concept and classification, Dynamics of Electric Drives, Types of Loads, Torque characteristics of Load, characteristics of Motor-Load combination, Dynamics of Motor-Load combination, Steady-state and Transient stability of Electric Drive. Characteristics of Electric Drives: Modified Speed-Torque Characteristics of D.C Shunt motors, D.C Series motor and Induction motors.

UNIT-II

Starting of Electric Motors: Methods of Starting Electric Motors, Acceleration time, Energy relation during starting, D.C Shunt and series Motor and Induction motors, Methods to reduce the energy loss during starting.

Electric Braking: Types of Braking – Regenerative braking, dynamic braking and plugging, Braking of DC Shunt motor, DC Series motor and 3-phase induction motor, Energy relation and dynamic of braking. Effect of load inertia and load equalization.

UNIT-III

D.C motor control: Single-phase controlled rectifier and chopper circuit arrangement for continuous armature current operation. Dual converter control, Circulating current and non-circulating current modes of operation, Principles of closed loop control for D.C drives.

UNIT-IV

Induction motor control: Speed control of 3-phase induction motor with A.C voltage regulators, Voltage source inverters and Cyclo-converters, Static rotor resistance control, slip power recovery schemes: Static Krammer drive and Scherbius drive.

UNIT-V

Synchronous motor control: Self controlled and separately controlled synchronous motors, Brushless D.C motors, Switched reluctance motors.

Suggested Reading:

1. S.K.Pillai, A First Course in Electrical Drives, New Age International, 2000.
2. GK.Dubey, Fundamentals of Electric Drives, Narosa Public House, Delhi, 2001.
3. M.D. Singh and K.B.Khanchandani, Power Electronics, Tata McGraw Hill Publishing Company Ltd., 2000.
4. Bimal.K.Bose, Modern Power Electronics and AC Drives, Pearson Education Asia, 2002.

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EE 3120 FINISHING SCHOOL – TECHNICAL SKILLS

Syllabus for B.E 3/4 II-SEMESTER

Instruction	2 Per Week
Final Examination	35 Marks
Sessional	15 Marks
Credits	1

Course objective:	Course Outcomes:
The course will enable the students to: The objective of the course is to create Java Programs by using object-oriented features and implement error-handling techniques using exception handling, and to explain the need of database for storing, accessing and updating the data, eliminate the redundant data.	**At the end of the course student will be able to:** 1. The student will be able to demonstrate the principles of the object oriented programming. 2. The student will be able to create packages. handle errors using Exception Handling, and create threads using Multithreaded Programming concepts. 3. The student will be able apply the concepts of classes present in lang, IO package . 4. Students will be able to identify the purpose of different database languages and data models 5. Students will be able to explain the operations of relational model using SQL

UNIT – I

Object Oriented System Development: Understanding Object Oriented Development, Understanding Object Concepts, Benefits of Object Oriented Development.

Java Programming Fundamentals: Introduction, Overview of Java, Data types, Variables and Arrays, Operators, Control statements, Classes, Methods, Inheritance

UNIT- II

Packages and Interfaces, Exception Handling, Multithreaded Programming,

UNIT- III

I/O basics, Reading console input and output, Reading and Writing Files, String Handling.

Exploring Java Language, Collections Overview, Collections Interfaces, Collections Classes.

UNIT - IV

Introduction: Overview, File System vs DBMS, Advantages of DBMS, Database System Applications, Relational Databases, Object – Based and Semi-structured Databases, Data Storage and Querying, Database Architecture, Database Users and Administrators.

Database Design and the E-R Model: Overview of the Design Process, The E-R Model, Constraints, E-R Diagrams, E–R Design Issues, Weak Entity Sets, Extended E-R Features, Reduction to Relational Schemas, Other Aspects of Database Design.

UNIT – V

Relational Model: Structure of Relational Databases, Fundamental Relational-Algebra Operations, Additional Relational – Algebra Operations, Extended Relational - Algebra Operations, Null Values, Modification of the Databases.

Structured Query Language: Data Definition, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null Values, Nested Sub queries, Complex Queries, Views, Modification of the Database, Joined Relations.

Suggested Reading :

1. Herbert Schildt, The Complete Reference Java, 7th Edition, Tata McGraw Hill, 2006.
2. Abraham Silberschatz, Henry F Korth, S. Sudarshan, Database System Concepts, Sixth Edition, McGrah-Hill International Edition, 2010.
3. Ramakrishnan, Gehrke, Database Management Systems, Third Edition, McGrah-Hill International Edition, 2003.

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EE 3061 - ELECTRICAL MACHINES LAB – II

Instruction	2 Periods per week
Duration of Final Examination	3 Hours
Final Examination	50 Marks
Sessional	25 Marks
Credits	1

Course objective:	Course Outcomes:
The main objective of the course is to give the students an insight into the constructional details of the induction and synchronous machines with a view of better understanding of their working principles. The course also equips the students to test and evaluate the performance of induction and synchronous machines by conducting appropriate experiments.	1. Estimate or test the performance of induction and synchronous machines by conducting suitable experiments and report the results. 2. Predetermine the voltage regulation of Non salient and Salient Alternators by conducting suitable tests. 3. Evaluate the various characteristics of ac machines by conducting suitable experiments. 4. Communicate effectively and support constructively towards team work. 5. Pursue lifelong learning for career and professional growth with ethical concern for society and environment.

List of Experiments:

1. Three phase to Two phase conversion (Scott Connection)
2. Heat run test on Three phase transformer.
3. No-load test, blocked rotor test and load test on 3-phase Induction motor.
4. Speed control of three phase induction motor by
   (a) Cascade connection
   (b) Stator Voltage control method
   (c) Rotor impedance control
   (d) Pole changing
   (e) Rotor slip recovery – Kramer drive
   (f) V/F Control
5. Performance characteristics of single phase induction motor.
6. Voltage regulation of Alternator by
   a. Synchronous impedance method
   b. Ampere – turn method
   c. Z.P.F. method.

7. Regulation of Alternator by slip test.
8. Determination of V curves and inverted V curves of Synchronous motor.
9. Power angle characteristics of a Synchronous motor.
10. Load characteristics of Induction Generator.
11. P.F. improvement of Induction motor using capacitors.
12. Synchronization of Alternator using three dark lamp method.

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EE 3071 - POWER ELECTRONICS LAB

Instruction	2 Periods per week
Duration of Final Examination	3 Hours
Final Examination	50 Marks
Sessional	25 Marks
Credits	1

Course objective:	Course Outcomes:
The objective of the lab is to provide an experience in working with power converters and enhance the analyzing capability by introducing simulation tools for power converters.	A successful graduate will be able to 1. Obtain the characteristics of power electronic devices. 2. Operate power electronic converters for any given application. 3. Apply the knowledge of power converters to operate electrical machines as drives. 4. Develop power electronic converter models using software.

List of experiments:

1. Characteristics of SCR, power BJT, MOSFET and IGBT
2. Gate trigging circuit for devices (SCR, BJT, MOSFET and IGBT) using R, R – C and UJT's and IC's
3. 1 – Ø AC voltage controller with R & R – L loads
4. 1 – Ø step down cyclo – converter with R & R – L loads
5. Study of forced commutation techniques
6. Two quadrant D.C drive
7. Buck – boost choppers
8. 1 – Ø bridge rectifiers: half and full control with R & R – L loads
9. Study of UPS & SMPS
10. V/f control of A.C drive
11. Simulation of 1-Ø full & semi converter
12. Simulation of 1-Ø & 3-Ø inverter
13. 1 – Ø inverter with R and R – L loads

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EE 3081 - INTEGRATED CIRCUITS LAB

Instruction	2 Periods per week
Duration of Final Examination	3 Hours
Final Examination	50 Marks
Sessional	25 Marks
Credits	1

Course objective:	Course Outcomes:
To acquire skills of designing and testing of digital and analog integrated circuits.	Students will be able to 1. Analyze and design various applications of Op-Amp. 2. Construct and troubleshoot circuits containing linear integrated circuits. 3. Design combinational and sequential logic circuits using IC's.

List of Experiments.:

1. Generation of Triangle and square wave using 741op-amp.
2. PLL (Phase locked loop).
3. Design of astable multivibrator using 555 timer.
4. Active filters.
5. Instrumentation amplifier using 741 op-amp.
6. Design of integrator and differentiator using op-amp.
7. Multiplexer applications for logic Realization of combinational circuits.
8. synchronous counters.
9. Asynchronous counters.
10. Study of clipping and clamping circuits using op-amps
11. Design of monostable multivibrator.
12. Boot-strap sweep circuit using op-amp.
13. Study of half adder, full adder and half and full subtractor and realization of combinational logic.
14. A/D converters.
15. D/A converters.

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