Syllabus for the Academic Year – 2020 - 2021

Department: Electrical & Electronics Engineering

Semester: III

Subject Name: ANALOG ELECTRONIC CIRCUITS

Subject Code: PC-18EEI302 **L-T-P-C: 3-0-2-4**

Course Objectives:

1. Understand the concepts of biasing, stabilization, amplifiers and oscillators.
2. Apply the concept of biasing for different configurations of transistor.
3. Analyze frequency response and stability for amplifiers and oscillators.
4. Design an amplifier and oscillator for suitable operating point.

UNIT	Syllabus	Hours
1	**Transistor Biasing and Stabilization:** Operating point, Bias stability, Self-Bias or Emitter bias, Stabilization factors, Bias compensation	8
2	**Transistors Frequency Response**: Introduction to CE, CC, CB configuration, Introduction to h parameter, Analysis of CE amplifier, Miller's theorem and its dual, Emitter follower, Comparison of transistor configuration, Darlington emitter follower, Bootstrapped Darlington circuit.	8
3	**Amplifiers**: Introduction, Classification of amplifiers, Distortion in amplifiers, frequency response of an amplifier, RC coupled amplifier. Introduction to feedback amplifiers and types. **FET**: Introduction, types of biasing, FET as an amplifier	8
4	**Power Amplifiers**: Class A large signal amplifiers, Second harmonic distortion, Higher order harmonic generation, Transformer coupled audio power amplifier, Efficiency, Push-pull amplifier, Class B amplifiers.	8
5	**Oscillators:** Oscillator operation, phase-shift oscillator, Wein-bridge oscillator, Tuned oscillator, Crystal oscillator.	7

LABORATORY EXPERIMENTS

1	Determination of gain –frequency response, input and output impedances of RC coupled Single stage BJT amplifier.
2	Determination of the gain, input and output impedances of BJT Darlington Emitter follower with and without bootstrapping
3	Testing the performance of BJT/FET-RC phase shift Oscillator for f_0<10 KHz.
4	Testing the performance of BJT- Hartley Oscillator for RF rangef_0>100 KHz.
5	Testing for the performance of BJT/FET-Crystal Oscillator for f0>100 KHz.

Course Outcome:

After completion of course, student will be able to:

1. Understand the concepts of biasing, stabilization, amplifiers and oscillators.
2. Apply the concept of biasing for different configurations of transistor.
3. Analyze frequency response and stability for amplifiers and oscillators.
4. Design an amplifier and oscillator for suitable operating point.

Text Books:

1. Electronic Devices and Circuits, Millman, Halkias, McGraw Hill,4th Edition, 2015
2. Electronic Devices and Circuits, David A Bell, Oxford Press,5th Edition, 2008

Reference Books:

1. Fundamentals of Analog Circuits, Thomas L Floyd, Pearson, 2nd Edition, 2012
2. Electronic Devices and Circuits, S. Salivahanan, N.Suresh, McGraw Hill, 3rd Edition, 2013
3. A Text Book of Electrical Technology, Electronic Devices and Circuits, B.L. Theraja, A.K. Theraja, S. Chand, Reprint, 2013.

Self Study: NPTEL: "Analog Electronic Circuit" Prof. Shouri Chatterjee, IIT Delhi

Syllabus for the Academic Year – 2020 - 2021

Department: Electrical & Electronics Engineering

Semester: III

Subject Name: ELECTRIC CIRCUIT ANALYSIS

Subject Code: PC-18EE303 **L-T-P-C: 4-0-0-4**

Course Objectives:

1. To understand the concept of circuit analysis.
2. To apply the solution techniques to solve Electric Circuits.
3. To analyze the given circuit to obtain the solution.
4. To evaluate the Electrical quantities for any excitation.

UNIT	Description	Hours
I	**Basic Concepts:** Practical sources, Source transformations, Network reduction using Star-Delta transformation, Loop and node analysis with linearly dependent and independent sources. **Network Theorems:** Superposition theorem, Reciprocity theorem, Millman's theorem (independent sources only).	**11**
II	**Network Theorems:** Thevenin's and Norton's theorem, Maximum Power transfer theorem (independent sources only). **Resonant Circuits:** Series and parallel resonance, Frequency response of series and parallel circuits, Q factor, Bandwidth.	**11**
III	**Poly phase Circuits:** Analysis of Three phase Circuits with balanced and unbalanced loads, Concept of Neutral shifting, measurement of power in balanced and unbalanced load (Illustrative Examples)	**10**
IV	**Laplace Transformation & Applications:** Review of Laplace transforms, Waveform synthesis, Initial and final value theorems, Step, ramp and impulse responses, Convolution theorem, Solution of simple R-L, R-C, R-L-C networks for AC and DC excitations using Laplace transforms.	**10**
V	**Two port network parameters:** Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets, Problems	**10**

Course Outcomes:

After completion of course, student will be able to:

1. Understand the concept of circuit analysis.
2. Apply the solution techniques to solve Electric Circuits.
3. Analyze the given circuit to obtain the solution.
4. Evaluate the Electrical quantities for any excitation.

Text Book:

Network Theory: Analysis and Synthesis, Smarajit Ghosh, PHI, 2005

Reference Books:

1. Engineering Circuit Analysis, Hayt, Kemmerly and Durbin, 6th Edition, 2002
2. Network Analysis, M.E. VanValkenburg, 3rd Edition, Reprint 2002
3. Network and systems, Roy Choudhury, 2nd edition, 2006 reprint, New Age
4. Theory and Problems of Electric Circuits, Schaum`s Series, 2nd Edition

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Syllabus for the Academic Year – 2020 - 2021

Department: Electrical & Electronics Engineering

Semester: III

Subject Name: DC MACHINES AND SYNCHRONOUS MACHINES

Subject Code: PC-18EE304 **L-T-P-C: 3-1-0-4**

Course Objectives:

1. To understand the concepts of excitation and characteristics of electrical Machines.
2. To apply the testing methods on DC and Synchronous Machines.
3. To analyze the methods of speed control of DC Machines
4. To evaluate the performance of DC and Synchronous Machines.

UNIT	Description	Hours
I	**DC Generator:** Types of excitation, No load & Load characteristics, Armature reaction and its effects, Commutation, use of Inter poles and compensating winding, Problems on Excitation, load characteristics and calculation of demagnetizing , cross magnetizing Ampere turns (AT_d and AT_c) per pole.	**10**
II	**DC Motors:** Characteristics of shunt, series, compound motors & their applications. Speed control of shunt and series motors. Permanent magnet DC motor. Problems on speed control. Testing of DC machine: Losses & efficiency, direct loading, Swinburne's test and Hopkinson's test, Problems on efficiency calculation.	**10**
III	**Synchronous Machines:** Basic Principles of Operation, Construction of Salient & Non - Salient Pole Synchronous Machines, Generated Emf in a Concentrated Winding, Effect of Distribution of Winding, Problems on EMF equation. **Salient Pole Synchronous Machines**: Two Reaction Theory, Power- Angle Diagram, Reluctance Power, Slip Test, Problems on Power angle characteristics.	**10**
IV	Regulation by EMF, MMF and ZPF methods, Synchronizing to infinite bus bars, parallel operation of alternators, Problems on regulation calculation and load sharing between the alternators for constant and variable excitations.	**11**
V	**Operating characteristics of synchronous Machine:** Power-Angle Characteristics, excluding armature resistance, operation at constant load with variable excitation and vice versa for generating and motoring mode. **V** and **δ** curves of synchronous machines. Synchronous condenser, Power flow equation including armature resistance, capability curves of synchronous generators. Hunting in synchronous machines, damper windings, starting methods of synchronous motor.	**11**

Course Outcomes:

At the end of the course, student will be able to:

1. Understand the concepts of excitation and characteristics of electrical Machines.
2. Apply the testing methods on DC and Synchronous Machines.
3. Analyze the methods of speed control of DC Machines
4. Evaluate the performance of DC and Synchronous Machines.

Text Book:

Principles of Electrical Machines, V. K. Mehta & Rohith Mehta, 2nd Edition, 2009, S. Chand & Company Ltd.

Reference Books:

1. Electrical Machines, I J Nagrath and D P Kothari, 3rd Edition, 2010, Tata McGraw Hill Education Pvt. Ltd,
2. Electric Machines, Ashfaq Hussian, 2nd Edition, 2010, Dhanpat Rai Company.
3. Electrical Machinery, Bhimbra, 5th edition, 2018, Khanna Publications.
4. Text book of Electrical Technology, Volume 2, B L Thereja, S Chand publication

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Syllabus for the Academic Year – 2020- 2021

Department: Electrical & Electronics Engineering

Semester: III

Subject Name: ELECTRICAL MEASUREMENTS AND MEASURINGINSTRUMENTS

Subject Code: PC-18EE305 **L-T-P-C: 3-0-0-3**

Course Objectives:

1. To understand the concept of transducers & measuring instruments.
2. To apply the measurement techniques to measure circuit parameters and electrical quantities.
3. To analyze the working principle of measuring instruments.
4. To design the proper instruments for measuring the electrical quantities.

UNIT	Description	Hours
I	**Measurement of Impedance :** Classification of resistance ,Wheatstone bridge- sensitivity analysis, limitations, Kelvin's double bridge, Megger, Measurement of earth resistance by fall of potential method, Andersons bridge, Maxwell's bridge, Schering's bridge, Sources and detectors	**08**
II	**Extension of Instrument ranges-** shunts and multipliers, construction and theory of instrument transformers, equations of ratio and phase angle errors of C.T and P. T (derivation excluded), illustrative examples	**08**
III	**Measurement of Power & Energy related Parameters:** Construction and operation – Dynamometer type wattmeter, LPF wattmeter, Digital energy meter, Maximum demand indicator, Tri-vector meter, single phase power factor meter (electrodynamometer type), Weston frequency meter and phase sequence indicators.	**08**
IV	**Electronic Instruments**- Introduction, True RMS responding voltmeter, Electronic multi-meter, Digital Voltmeters – Ramp type, Successive approximation, LCR meter, Dual trace Oscilloscope- introduction, basic principle, block diagram, Dual beam and dual trace CROs.	**08**
V	**Transducers** - Introduction, electrical transducers, selection, resistive transducers, strain gauges, expression for gauge factor, thermocouples, LVDT, inductive transducers, capacitive transducers, Piezoelectric transducers, photo electric transducers, Hall effect sensors, introduction to data acquisition system	**07**

Course Outcomes:

At the end of the course, student will be able to:

1. Understand the concept of transducers & measuring instruments.
2. Apply the measurement techniques to measure circuit parameters and electrical quantities.
3. Analyze the working principle of measuring instruments.
4. Design the proper instruments for measuring the electrical quantities.

Text Book:

A course in Electrical and Electronic Measurements and Instrumentation, A K Sawhney, Fifth edition, 2009

Reference Books:

1. Electrical and Electronics Measurements and instrumentation, J B Guptha, fifth edition, 2015
2. Principles of measuring systems, John P Bently, Fourth edition, 2012.

Syllabus for the Academic Year – 2020 - 2021

Department: Electrical & Electronics Engineering

Semester: III

Subject Name: ELECTRICAL POWER GENERATION TECHNOLOGY

Subject Code: ES-18EE306 **L-T-P-C: 3-0-0-3**

Course Objectives:

1. To understand the concept of energy sources and power generation techniques.
2. To interpret the different methods of power generation.
3. To discriminate with different methods of power generations and its implications.
4. To evaluate the economic aspects of power generations.

UNIT	Description	Hours
I	**Introduction to energy sources-** Conventional energy sources-nuclear, thermal, diesel, gas. Non-conventional energy sources- solar, wind, ocean, tidal, geothermal. Energy scenario**.** **Solar Power Generation-** Solar cell principle, basic Photovoltaic power plant, applications of solar PV systems, advantages & disadvantages of PV energy conversion, Solar pond electric power plant.	**08**
II	**Wind and Biogas power generation-** Basic components of wind energy conversion system, classification of WECS- Horizontal axis & Vertical axis machines, advantages & disadvantages of WECS, Biogas power generation, types, advantages and disadvantages. **Ocean & Tidal power generation-** Basic principle of ocean thermal energy conversion, open cycle, closed cycle & hybrid cycle OTEC system, Tidal power plants- Single basin & double basin arrangements, advantages & limitations of tidal power generation.	**08**
III	**Hydro-Electric Power Plant-**Selection of site, classification of hydro electric plants, general arrangement and operation of hydro electric plant. **Thermal Power Plant**- Schematic layout & working of Thermal Power Station, description of main parts of Thermal Power Plant.	**08**
IV	**Nuclear Power Plant-** Components of nuclear reactors, Schematic layout & operation of nuclear power plant, types of nuclear reactors, radiation hazards & safety precautions. **Diesel Power Plant-** Components of diesel power plant, plant layout & maintenance.	**08**
V	**Economic aspects-** Terms commonly used in system operation: Diversity factor, load factor, plant capacity factor, plant use factor, plant utilization factor, loss factor, load duration curve, energy-load curve, numerical problems. Power factor improvement and tariffs.	**07**

Course Outcomes:

At the end of the course, student will be able to:

1. Understand the concept of energy sources and power generation techniques.
2. Interpret the different methods of power generation.
3. Discriminate with different methods of power generations and its implications.
4. Evaluate the economic aspects of power generations.

Text Books:

1. Non-conventional sources of energy. D. Rai, Khanna Publication 2012
2. Electric Power Generation Transmission and Distribution, S M Singh, P.H.I., New Delhi 2010

Reference Books:

1. Solar energy, Sukhatme, TMH Publication, 2nd edition
2. Power System Engineering, A Chakrabarthi, M L Soni, P V Guptha&Dhanpat, US Bhatnaga, Dhanpat rai Publication, 2009 edition
3. Elements of Power System Design, M V Deshpande, Tata McGraw hill, New Delhi, 2004 edition

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Syllabus for the Academic Year – 2020 - 2021

Department: Electrical & Electronics Engineering

Semester: III

Subject Name: CIRCUIT SIMULATION AND MEASUREMENTS LABORATORY

Subject Code: PC-18EE307 **L-T-P-C: 0-0-2-1**

Course Objectives:

1. To understand the basic concepts of network theorems, resonance, AC and DC bridges.
2. To apply the concept of network theorems to obtain electrical quantities and to measure value of unknown electrical parameters.
3. To verify network theorems using software package

SL. NO.	Description
I	Measurement of low resistance using Kelvin's double bridge.
II	Measurement of Inductance and quality factor of coil using Maxwell's Inductance bridge.
III	Measurement of Capacitance and its dissipation factor using Desauty's bridge.
IV	Verification of KCL & KVL for DC circuits.
V	Verification of Superposition theorem.
VI	Verification of Reciprocity theorem.
VII	Verification of Millman's theorem.
VIII	Verification of Maximum Power Transfer theorem
IX	Verification of Thevenin's theorem
X	Resonance characteristics for series and parallel circuits

Course Outcomes:

At the end of the course, student will be able to:

1. Understand the basic concepts of network theorems, resonance, AC and DC bridges.
2. Apply the concept of network theorems to obtain electrical quantities and to measure value of unknown electrical parameters.
3. Verify network theorems using software package.

Syllabus for the Academic Year – 2020 - 2021

Department: Electrical & Electronics Engineering

Semester: III

Subject Name: DC MACHINES AND SYNCHRONOUS MACHINES LABORATORY

Subject Code: PC-18EE308 **L-T-P-C: 0-0-2-1**

Course Objectives:

1. To understand the concepts of excitation, characteristics of DC and Synchronous Machines.
2. To apply the knowledge on testing of DC and Synchronous machines
3. To evaluate the performance of DC and Synchronous machines.

SL. NO.	Description
I	No load and Load characteristics of DC shunt generators.
II	Load test on DC shunt motor to determine its characteristics.
III	Speed control of dc shunt motor by voltage control and flux control.
IV	Swinburne's test or No Load Test on DC shunt Motor.
V	Ward Leonard method of speed control of dc motor.
VI	Hopkinson's test or Back to Back Test or Regenerative Test on DC Shunt Machines.
VII	Voltage Regulation of an Alternator by EMF or Synchronous Impedance Method.
VIII	Voltage Regulation of an Alternator by MMF or Ampere Turn Method.
IX	Voltage Regulation of an Alternator by ZPF or Potier Triangle Method.

X	Slip Test on a salient Pole Synchronous Machine.
XI	Performance of synchronous generator connected to infinite bus, constant power – variable excitation and vice-versa.
XII	V & inverted V curve of synchronous motor.

Course Outcomes:

After completion of course, student will be able to:

1. Understand the concepts of excitation, characteristics of DC and Synchronous Machines.
2. Apply the knowledge on testing of DC and Synchronous machines
3. Evaluate the performance of DC and Synchronous machines.