



Swaminarayan University

Teaching & Examination Scheme

Course – Faculty of Engineering (Degree)

Branch – Electrical Engineering

Semester – 4th

Subject Code	Subject Name	Category	L	T	P	Total Credit	E	M	I	V	Total Marks
BE105401	Engineering Economic Analysis	Humanities and Social Science	3	0	0	3	60	40	0	0	100
BE105402	Electrical Measurement and Instrumentation	Basic Science	4	0	2	5	60	40	20	30	150
BE105403	DC Machine and Transformer	Professional Core	3	0	2	4	60	40	20	30	150
BE105404	Power Electronics Converters and Controllers	Professional Core	4	0	2	5	60	40	20	30	150
BE105405	Electrical Power systems - 1	Professional Core	4	0	2	5	60	40	20	30	150
	Total		18	0	8	22					

L=Lecture, T=tutorial, P=Practical, E=Theory External, M=Theory Internal, I=Practical Internal, V=Practical External



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: Electrical Engineering

Subject Code: BE105402

Subject Name : Electrical Measurement And Instrumentation

w.e.f.Academic Year:	2023-24
Semester:	4 th
Category of the Course:	Basic Science

Prerequisite:	Basic Science
Rationale:	Electrical installations ranging from residential consumers to huge industrial estates all are equipped with measuring instruments. In view of this, study of principles of Electrical measurements and measuring instruments becomes mandatory for all electrical engineers. This subject deals with principles of measurements, analog and measuring instruments as well as transducers.

Teaching and Examination Scheme –

Hours per Week			Course Credits	Examination Marks				150
L	T	P		Theory Marks		Practical Marks		
				E	M	I	V	
3	1	2	5	60	40	20	30	

Detailed Syllabus –

Unit	Content	Hours	% Of Weight
1	Concepts of Measurement: Measurement System, Classification of instrument system, Methods of Measurement, Static Characteristics like accuracy, precision, sensitivity, linearity, range, reproducibility, drift, threshold, dead zone etc. Dynamic Characteristics like speed of response, fidelity overshoot etc., Measurement Standards Errors in measurement, Basic statistical evaluation of measurement data and errors - mean, standard deviation, Six sigma estimation.	06	30
2	Transducers and Sensors: Definition, different types of transducers, criteria for selection, general characteristics and dynamic characteristics, transducers for measurement of temperature ((Thermocouple and RTD), transducers for measurement of pressure, strain, transducers for measurement of displacement, speed, torque, Hall Effect transducer Sensors – basic concept – Speed and position sensors	10	30
3	Measurement of Parameters: Measurement of resistance, Extending the range of meters - Shunts, Potential divider, Instrument Transformer and their applications in the extension of instrument range, Measurement of	10	15



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: Electrical Engineering

Subject Code: BE105402

Subject Name : Electrical Measurement And Instrumentation

	voltage, current, power, energy, power factor and frequency (constructions and operating principles of corresponding instruments)		
4	D.S.O.: Digital recorders, Digital Storage Oscilloscope - Block Diagram, theory and applications, Power scope	03	15
5	Display devices: Characteristics of digital display, DVM and Digital multi meter, Clamp on meter, Megger.	03	10
	Teaching hours	32	100

Course Outcomes-

CO No	Course Outcome Description	RBT Level
CO1	Comprehend the basics of electrical measurements.	Understand
CO2	Explain the principle, working, characteristics, and applications of measuring instruments and transducers.	Understand
CO3	Apply bridge circuits for measurement of resistance, inductance, and capacitance Prepare specifications for measurement systems for specific applications.	Apply
CO4	Prepare specifications for measurement systems for specific applications.	Evaluate

CO\PO MATRIX

CO \ PO	CO1	CO2	CO3	CO4
PO1 Basic knowledge	3	3	3	2
PO2 Discipline knowledge	3	3	3	3
PO3 Experiments and practice	2	2	3	2
PO4 Engineering tools	-	2	3	3
PO5 The engineer and society	-	-	-	-
PO6 Environment and sustainability	-	-	-	-
PO7 Ethics	-	-	-	-
PO8 Individual and team work	-	-	-	-
PO9 Communication	2	2	2	3
PO10 Life-long learning	2	2	2	3

CO\PSO MATRIX

CO \ PSO	PSO1(Apply measurement techniques using instruments)	PSO2(Use tools and software for circuit and data analysis)
CO1	3	2
CO2	3	2
CO3	3	3
CO4	3	3



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: Electrical Engineering

Subject Code: BE105402

Subject Name : Electrical Measurement And Instrumentation

Reference Books –

- Gupta J. B., “A Course in Electronics and Electrical Measurements and Instrumentation”, S.K. Kataria & Sons
- A.K. Sawhney, “Electrical and Electronic Measurements and Instrumentation”, DHANPATRAI & CO.
- Golding & Widis, ‘Electrical Measurement and Measurement instrument’, Wheeler Books
- D. Patranabis, ‘Sensors & Transducers’, PHI.
- H. S. Kalsi, " Electronic Instrumentation", Tata McGraw-Hill Education.
- A.J. Bouwens, ‘Digital Instrumentation’, Tata Mc-Graw hill.

List of Practical –

- To measure value of unknown capacitance by Schering’s bridge.
- To measure unknown inductance by & demonstrate operation of Maxwell's bridge.
- To demonstrate distance measurement using LVDT.
- To demonstrate the Kelvin Double Bridge for Low resistance measurement.
- To measure value of unknown capacitance by Owen’s bridge.
- To measure value of unknown inductance using LCR meter.
- To measure high resistance and insulation resistance using Megger.
- To demonstrate usage of DSO for steady state periodic waveforms produced by a function generator.
- To measure value of unknown capacitance using LCR meter.
- Measurement of current using shunt.

List of Major Equipment –

- Necessary number of meters, accessories and instruments etc... to be provided to conduct the above experiments in a group of maximum 4 students. Charts and cut section models of various instruments should be provided for better understanding.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: Electrical Engineering

Subject Code: BE105405

Subject Name : Electrical Power System -1

w.e.f.Academic Year:	2023-24
Semester:	4 th
Category of the Course:	PCC

Prerequisite:	Professional Core
Rationale:	The course is aimed to provide exposure about methods of electricity generation, various AC supply systems, transmission lines and their parameters, underground cables and their parameters, substation equipment, neutral grounding and sources of over-voltages and protection against them.

Teaching and Examination Scheme –

Hours per Week			Course Credits	Examination Marks				150
L	T	P		Theory Marks		Practical Marks		
				E	M	I	V	
4	0	2	5	60	40	20	30	

Detailed Syllabus –

Unit	Content	Hours	% Of Weight
1	Conventional Generation, Load Curves and Tariffs: Generation scenario in India and Gujarat Steam power station, Schematic arrangement of steam power station, Equipments of steam power station, Hydroelectric power station, Schematic arrangement of hydro-electric power station, Constituents of hydro-electric plants, Nuclear power station, Schematic arrangement of nuclear power station, Nuclear reactor, Gas turbine power plant, Schematic arrangement of gas turbine power plant, comparison of various power plants. Load curves, Important terms and factors, Load duration curve, Examples. Tariff, Desirable characteristics of tariff, Types of tariff, Examples.	08	25
2	Introduction to Wind and Solar Power Generation: The wind power plant – Introduction, wind turbine classes, Wind Turbine Components (Rotor, Nacelle, Tower, Electric Substation, Foundations) Wind Energy Conversion – Rotation principle, Forces on a rotor blade, Factors affecting performance of rotor	08	15



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

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Subject Code: BE105405

Subject Name : Electrical Power System -1

	(Aerodynamic efficiency, tip speed, tip speed ratio etc.), Thrust and torque on rotor, Power curve.		
3	Power Factor and Power Factor Improvement of Load: Power factor, Power factor triangle, Causes of low power factor, Disadvantages of low power factor, Power factor improvement, Power factor improvement equipment, Calculations of power factor correction, Most economical power factor, Examples.	05	10
4	Mechanical Features and Design of Overhead Transmission Line: Main components of overhead lines, Conductor materials, Line supports, Insulators, Types of insulators, String efficiency, Methods of improving string efficiency, Examples, Sag in overhead lines, Calculation of sag, Examples.	08	25
5	Underground Cables: Underground cables, construction of cables, Insulating materials of cables, Classification of cables, Cables for 3-phase service, Insulation resistance of a single core cable, Capacitance of a single core cable, Dielectric stress in single core cable, Most economical conductor size in cable, Grading of cables, Capacitance grading, Intersheath grading, Capacitance of 3-core cables, Measurement of core to core and core to earth capacitances, Examples.	07	15
6	Substations: Classification of substations, Transformer substation, Pole mounted substation, Underground substation, Symbols for equipments in substations, Equipments in a transformer substation, Bus-bar arrangements in substations, Terminal and through substations, Key diagrams of 66/11 kV substation and 11/400 kV indoor substation	04	10
	Teaching hours	40	100

Course Outcomes-

CO No	Course Outcome Description	RBT Level
CO1	Compare various means of electricity generation and evaluate load curves, tariff structures, and power factor improvement.	Understand
CO2	Carry out the mechanical design of overhead transmission lines.	Apply
CO3	Compute resistance, inductance, and capacitance of overhead lines and underground cables.	Apply
CO4	Acquire knowledge about electrical supply systems, substation equipment, layout, and grounding methods.	Understand
CO5	Analyze the generation scenario and power plants in Gujarat and India	Understand



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

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Subject Code: BE105405

Subject Name : Electrical Power System -1

CO6	Develop programs to compute design and performance parameters of power systems.	Apply
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CO\PO MATRIX

CO \ PO	CO1	CO2	CO3	CO4	CO5	CO6
PO1 Basic knowledge	3	3	3	2	2	3
PO2 Discipline knowledge	3	3	3	2	2	3
PO3 Experiments and practice	2	3	3	2	2	3
PO4 Engineering tools	-	2	2	2	2	3
PO5 The engineer and society	-	-	-	-	-	-
PO6 Environment and sustainability	-	-	-	-	-	-
PO7 Ethics	-	-	-	-	-	-
PO8 Individual and team work	-	-	-	-	-	-
PO9 Communication	2	2	2	2	2	2
PO10 Life-long learning	2	2	2	2	2	3

CO\PSO MATRIX

CO \ PSO	PSO1(Apply power system fundamentals to real-world systems)	PSO2(Use software tools to simulate and analyze power networks)
CO1	3	2
CO2	3	2
CO3	3	3
CO4	3	2
CO5	3	2
CO6	3	3

Reference Books –

- Principles of Power System: V. K. Mehta, Rohit Mehta, S. Chand Publications
- Wind Power Technology: Earnest Joshua, PHI Learning Pvt. Ltd
- Power System Analysis: Hadi Saadat, McGraw Hill Education India Pvt. Ltd.
- Electrical Power systems: C. L .Wadhwa, New Age International Publishers
- Power System Analysis : John J. Grainger, William D. Stevenson Jr., McGraw Hill Education
- Modern Power system Analysis by I J Nagrath, D P Kothari, McGraw Hill Education

List of Practical –

- Survey of generation scenario and power plants of Gujarat.
- Survey of different type of power plants of India to observe the power and energy supplied by them daily, their rates of energy, daily schedule etc.
- Plot VI and PV characteristics of solar cell/panel.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: Electrical Engineering

Subject Code: BE105405

Subject Name : Electrical Power System -1

- Simulation of three phase system with three phase balanced load with neutral grounded
- Simulation of three phase system with three phase load, effect of unbalanced load on the voltages of phases with and without neutral grounded.
- Write a program to calculate string efficiency of string of insulating discs for voltage levels upto 400kv.
- Write a program for calculating line inductance for different conductor configurations and dimensions.
- Write a program for calculating line capacitance for different configurations and design of line.
- Write a program for calculating sag of transmission line under different loading conditions.
- Prepare layout of substation for a given bus arrangement and given voltage rating with all necessary equipments.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: Electrical Engineering

Subject Code: BE105401

Subject Name : Engineering Economics Analysis

w.e.f.Academic Year:	2023-24
Semester:	4 th
Category of the Course:	Social Science

Prerequisite:	Humanities and Social Science
Rationale:	Engineering economics is a field that addresses the dynamic environment of economic calculations and principles through the prism of engineering. It is a fundamental skill that all successful engineering firms employ in order to retain competitive advantage and market share. The subject endeavors to provide them with the tools to optimize profits, minimize costs, analyze various scenarios, forecast fluctuations in business cycles, and more.

Teaching and Examination Scheme -

Hours per Week			Course Credits	Examination Marks				100
L	T	P		Theory Marks		Practical Marks		
				E	M	I	V	
3	0	0	3	60	40	00	00	

Detailed Syllabus -

Unit	Content	Hours	% Of Weight
1	Economic Decisions Making: Overview, Problems, Role, Decision making process. Engineering Costs & Estimation: Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring and Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits. Case Study - Price and Income Elasticity of Demand in the real world	08	20
2	Cash Flow, Interest and Equivalence: Cash Flow: Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.	08	20
3	Cash Flow & Rate of Return Analysis: Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental	08	20



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: Electrical Engineering

Subject Code: BE105401

Subject Name : Engineering Economics Analysis

	Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis in The Public Sector - Quantifying And Valuing Benefits & drawbacks. Case Study – Tata Motors		
4	Inflation and Price Change: Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. Case Study – Competition in the Advertise Segment in India	08	20
5	Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.	08	20
	Teaching hours	40	100

Course Outcomes-

CO No	Course Outcome Description	RBT Level
CO1	Describe the principles of economics governing operations under various market conditions.	Understand
CO2	Comprehend macroeconomic principles and apply decision-making techniques in business contexts.	Understand
CO3	Explain inflation, price change effects, and apply present worth analysis in engineering economics	Understand
CO4	Apply economic principles through analysis of real-world case studies.	Apply

CO\PO MATRIX

CO \ PO	CO1	CO2	CO3	CO4
PO1 Basic knowledge	3	3	3	2
PO2 Discipline knowledge	2	3	3	2
PO3 Experiments and practice	-	2	2	3
PO4 Engineering tools	-	2	2	3
PO5 The engineer and society	-	-	-	-
PO6 Environment and sustainability	-	-	-	-
PO7 Ethics	-	-	-	-
PO8 Individual and team work	-	-	-	-
PO9 Communication	2	2	2	3
PO10 Life-long learning	2	2	2	3



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: Electrical Engineering

Subject Code: BE105401

Subject Name : Engineering Economics Analysis

CO\PSO MATRIX

CO \ PSO	PSO1(Apply economics to engineering decisions)	PSO2(Use cost-benefit and feasibility analysis for projects)
CO1	3	2
CO2	3	3
CO3	3	3
CO4	3	3

Reference Books -

- James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , TataMcGraw-Hill
- Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
- John A. White, Kenneth E. Case, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley
- Sullivan and Wicks: Engineering Economy, Pearson
- R. Paneer Seelvan: Engineering Economics, PHI
- Michael R Lindeburg : Engineering Economics Analysis, Professional Pub



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: Electrical Engineering

Subject Code: BE105404

Subject Name : Power Electronics Converters and Conductors

w.e.f.Academic Year:	2023-24
Semester:	4 th
Category of the Course:	PCC

Prerequisite:	Professional Core Course
Rationale:	The power electronic devices and converters employing power electronics devices are now widely used in domestic applications as well as in industrial applications like Electrical Drives, Power Systems, Renewable Energy based power generation, heating applications etc. The course is aimed to provide exposure about the commonly used power electronic devices and the power electronic converters.

Teaching and Examination Scheme –

Hours per Week			Course Credits	Examination Marks				150
L	T	P		Theory Marks		Practical Marks		
				E	M	I	V	
4	0	2	5	60	40	20	30	

Detailed Syllabus –

Unit	Content	Hours	% Of Weight
1	Power switching devices: Diode, Thyristor, MOSFET, IGBT; Static characteristics of these devices; Operation of power devices as switches and switching losses, Single-quadrant switches, two-quadrant and bidirectional switches; Firing circuit for thyristors; Gate drive circuits for MOSFET and IGBT.	06	20
2	DC-DC converters: Switching Voltage Regulators Linear voltage regulator, Concept of switching voltage regulators and advantages, Operation and Principle of Basic DC-DC converter topologies like Buck, Boost and BuckBoost converter, Various control techniques for output voltage control, Mathematical analysis for these converters for steady state, Concept of CCM and DCM and factors affecting them, Closed loop control for voltage regulation, Isolated converters: Forward converter and	12	20



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: Electrical Engineering

Subject Code: BE105404

Subject Name : Power Electronics Converters and Conductors

	Flyback converter; Multi-quadrant operation of DC-DC converters; Applications.		
3	DC-AC converters: Inverters Classification of Inverters, Half-bridge and full-bridge single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage, three-phase sinusoidal modulation, Three phase bridge inverter – 180° and 120° conduction mode, SPWM control, Third harmonic injection, SVPWM, Output voltage and frequency control, Harmonic spectrum, Harmonics and its effects, Applications	12	20
4	AC-DC Converters: Concept of phase control using half-wave single phase ac-dc converter, Single phase and three phase half wave and full wave, 1-phase and 3- phase half controlled and fully controlled converters, Analysis with R & RL load, Performance parameters for converters, Operation in continuous and dis-continuous mode, Reactive power considerations, Operation in conversion and inversion mode, Effect of source inductance, Power factor improvement techniques, Dual Converters, Applications	11	20
5	AC Voltage Controller: Triac characteristic and operating modes, Triac as Single-phase AC voltage controller, Principle of Phase Control, On-off Control, Mathematical analysis related to single-phase AC voltage controller, Three-phase AC voltage controller configurations: Operations, Waveforms, Analysis.	07	20
	Teaching hours	48	100

Course Outcomes-

CO No	Course Outcome Description	RBT Level
CO1	Analyze operation of power electronic devices and choose suitable devices for given applications.	Analyze
CO2	Evaluate various performance parameters of converters.	Evaluate
CO3	Implement and analyze different control techniques for power electronic converters.	Analyze
CO4	Choose and apply converter topology suitable for specific power electronic applications.	Apply



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch:Electrical Engineering

Subject Code: BE105404

Subject Name : Power Electronics Converters and Conductors

CO\PO MATRIX

CO \ PO	CO1	CO2	CO3	CO4
PO1 Engineering Knowledge	3	3	3	3
PO2 Problem Analysis	3	3	3	3
PO3 Design/Development of Solutions	2	2	3	3
PO4 Conduct Investigations of Complex Problems	-	2	3	2
PO5 Modern Tool Usage	2	2	3	3
PO6 The Engineer and Society	-	-	-	-
PO7 Environment and Sustainability	-	-	-	-
PO8 Ethics	-	-	-	-
PO9 Individual and Team Work	-	-	-	-
PO10 Communication	-	-	1	-
PO11 Project Management and Finance	-	-	-	-
PO12 Life-long Learning	1	2	2	2

CO\PSO MATRIX

CO \ PSO	PSO1(Power System & Electronics Proficiency)	PSO2(Application & Design Skills)
CO1	3	2
CO2	3	3
CO3	3	3
CO4	3	3

Reference Books –

- M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India,2009.
- N. Mohan, T. M. Undeland, W.M. Robbins, “Power Electronics: Converters, Applications AndDesign”, Wiley India Edition, 2007.
- R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science &Business Media, 2007.
- P.S. Bimbhra, “Power Electronics”, Khanna Publishers, New Delhi, 2012..
- L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.

List of Practical –

- Static and dynamic characteristic of SCR, MOSFET and IGBT



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: Electrical Engineering

Subject Code: BE105404

Subject Name : Power Electronics Converters and Conductors

- R, RC and UJT triggering of SCR
- To analyse the performance of single phase and three-phase full bridge thyristor rectifier for R and RL load.
- Duty ratio control for regulating the output voltage of DC-DC Buck/Boost/Buck-Boost Converter
- Modeling and simulation of closed-loop control of DC-DC Buck/Boost/Buck-Boost converter.
- To study the effect of inductance, switching frequency, duty cycle, load current on the Output ripple voltage of a step-down chopper (using simulation platform like MATLAB/Simulink)
- Performance of 1-phase bridge inverter with R and R-L load
- Study of harmonic spectrum of output voltage for unipolar and bipolar PWM controlled halfbridge and full bridge converter.
- Performance of 3-phase bridge inverter operating with 120° and 180° conduction mode.
- Simulation of SVPWM and to study its effectiveness over SPWM

List of Major Equipment –

- Power semiconductor devices, power electronic converter kits, CRO/DSO, choke coil, load bank, voltage and current probes, Simulation software like Scilab, MATLAB, PSIM etc. along with necessary toolbox.