PANDIT DEENDAYAL PETROLEUM UNIVERSITY

SCHOOL OF TECHNOLOGY

COURSE STRUCTURE FOR B.TECH. ELECTRICAL ENGINEEING

SEMESTER V			B.TECH. ELECTRICAL ENGINEEING											
Sr. No	Course Code	Course Name	Teaching Scheme					Exam Scheme						
								Theory			Practical		Total	
			L	T	P	C	Hrs/wk	MS	ES	IA	LW	LE/Viva	Marks	
1	EE 312T	Electromagnetics	3	1	--	7	4	30	60	10	--	--	100	
	--		--	--	--	--	--	--	--	--	--	--	--	
2	EE 313T	Microprocessors and Microcontrollers	3	0	--	6	3	30	60	10	--	--	100	
	EE 313P		--	--	2	1	2	--	--	--	25	25	50	
3	EE 314T	Modeling and Simulation	2	0	--	4	2	30	60	10	--	--	100	
	EE 314P		--	--	4	2	4	--	--	--	25	25	50	
4	EE 315T	Power Electronics	3	0	--	6	3	30	60	10	--	--	100	
	EE 315P		--	--	2	1	2	--	--	--	25	25	50	
5	EE 316T	Power System II	3	1	--	7	4	30	60	10	--	--	100	
	EE 316P		--	--	2	1	2	--	--	--	25	25	50	
6	EE 317T	Instrumentation and Control	3	0	--	6	3	30	60	10	--	--	100	
	EE 317P		--	--	2	1	2	--	--	--	25	25	50	
		Total	**17**	**2**	**12**	**42**	**31**						850	

MS = Mid Semester, ES = End Semester; IA = Internal assessment (like quiz, assignments etc)
LW = Laboratory work; LE = Laboratory Exam

EE 312T ELECTROMAGNETICS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	--	7	4	30	60	10	--	--	100

UNIT I **12**

GENERAL PRINCIPLES: The field concept. Source of Electromagnetic field – classification, potential, boundary conditions.

BOUNDARY VALUE PROBLEMS IN ELECTROSTATICS: Laplace and Poisson's equations, product solution method of solving Laplace's equation. Rectangular, Spherical and Cylindrical coordinates, Method of Images, Field plotting methods.

UNIT II **12**

CONFORMAL TRANSFORMATION TECHNIQUE: Complex transformations involving circular and elliptical boundaries, Bilinear and Sehwartz-christoffel transformations.

NUMERICAL METHODS: Finite difference equivalent of Laplace's equation. Iteration and relaxation methods.

UNIT III **12**

MAGNETOSTATIC FIELDS: Laws of magneto-statics – vector potential, Boundary value problems in magneto-statics, current sheet and flux sheet.

ELECTROMAGNETIC FIELDS: Maxwell's equations in point and integral forms, Relation between field theory and circuit theory.

UNIT IV **16**

ELECTROMAGNETIC WAVE EQUATION: Propagation of Electromagnetic waves in dielectrics and conductors, space sheet, transmission lines.

RADIATION AND ANTENNA: Retarded potential, Hertzian dipole, Antenna pattern, directivity and gain, Application of field theory to electrical devices.

TOTAL HOURS	**52**

Texts and References:

1. Rao, N. N., "***Elements of Engineering Electromagnetic***", 3rd Edition, Prentice Hall, India, 1992
2. Mathew, N. Sadiku, O., "***Elements of Electromagnetic***", 2nd Edition, Saunders College Publishing, 1994
3. Ramo, S., Whinnery, S., and Van Duzer, T., "***Fields and waves in communication electronics***", 3rd Edition, John Wiley and Sons, 1994.
4. Kraus, "***Electromagnetic***", 3rd Edition, McGraw Hill 1989.
5. Hayt William H., "***Engineering Electromagnetic***", McGraw Hill.

EE 313T MICROPROCESSORS AND MICROCONTROLLERS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **08**

INTERNAL ARCHITECTURE OF INTEL 8085 MICROPROCESSOR: Block diagram, Registers, Internal Bus Organization, Functional details of pins, Registers, ALU, Bus System, Control signals, Address / Data bus multiplexing and de-multiplexing.

ASSEMBLY LANGUAGE PROGRAMMING: 8085 instruction set: Instructions, Classifications, Addressing modes, Decision Making, Looping, Stack and Subroutines, Delay routines, Counters etc. and Programming examples. Timing Diagrams of various instructions, Interrupts.

UNIT II **04**

INTERFACING CONCEPTS AND DEVICES: I/ O mapped I/ O and memory mapped I/ O techniques, Serial communication and DMA features, Interfacing of Programmable Interfacing Devices like Programmable peripheral interface (Intel 8255), Programmable timer interface (Intel 8253/ 54), Programmable display / Keyboard interface (Intel 8279), Programmable serial communication interface (Intel 8251).

UNIT III **14**

INTRODUCTION TO 8051 MICROCONTROLLER: Introduction, Difference between Microprocessors and Microcontrollers. Architecture of 8051 Microcontroller, 8051 microcontroller hardware, Pin diagram of 8051, input/output pins, ports and circuits. Internal RAM and ROM, SFR's, Timers and Counters, Interrupt, Serial data communication (UART).

UNIT IV **13**

8051 ASSEMBLY LANGUAGE PROGRAMMING: 8051 Instruction Set, 8051 Addressing Modes, Assembly Programming, 8051 programming in C, 8051 Basic Programming, 8051 Timer Programming, 8051 Serial Port Programming, Interrupts Programming, Interfacing.

TOTAL HOURS	**39**

Texts and References:

1. Ramesh S. Gaonkar, "***Microprocessor Architecture, Programming, and Applications with the 8085***", Penram International.
2. William Kleitz, "***Microprocessor and Microcontroller fundamentals: The 8085 and 8051 Hardware and Software***"
3. Douglas V. Hall , "***Microprocessors, Interfacing and Peripherals***", 2nd Edition, Tata McGraw Hill,
4. Ajoy Ray, K Bhurchandi, "***Advanced Microprocessors and Peripherals***", Tata McGraw Hill
5. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay, "***The 8051 Microcontroller and Embedded Systems Using Assembly and C***", 2nd Edition, Pearson Education.
6. K. J Ayala, D. V. Gadre, "***The 8051 Microcontroller and Embedded Systems using Assembly and C***", Cengage Learning, India Edition.

EE 313P MICROPROCESSORS AND MICROCONTROLLERS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50

List of Experiments:

Experiments with the use of 8085 Microprocessor

1. Introduction to 8085 Training kit and Basic Programming in Assembly Language using 8085 Kits: Addition, Subtraction, Multiplication and Division.
2. Program to move a data block without overlap.
3. Programs for Code Conversion: Binary to BCD, BCD to Binary.
4. Programs for Counter: decimal up and down counter, Hex up and down counter.
5. Program to find smallest and largest number from N numbers.

Experiments with the use of 8051 Microprocessor

6. Introduction to 89C51 Microcontroller Kit and Basic Programming in Assembly Language using 8051 kit: 8 Bit Addition and Subtraction , Multi-Byte Addition, Multiplication of Two Numbers.
7. Arranging the array of numbers in ascending order.
8. Programs for Code Conversion: BCD to Hexadecimal and Hexadecimal to BCD conversion.
9. Counter using Timer and Program using Interrupt.
10. Hardware Experiments: Seven segment Display interfacing with 89C51; LCD interfacing with 89C51; Control the Stepper Motor using 89C51.

EE 314T MODELING AND SIMULATION										
Teaching Scheme					Examination Scheme					
					Theory			Practical		
L	T	P	C	Hrs/Week	MS	ES	IA	LW	LE/Viva	Total Marks
2	0	--	4	2	30	60	10	--	--	100

UNIT I **09**

SYSTEMS AND MODELS: Introduction to system, classification of systems, Models and Simulation, different types of mathematical models, Building and verifying models.

PHYSICAL MODELING: General Principles of modeling, Examples of dynamic mathematical models, circuits as dynamic systems, distinguished role of differential equations in developing mechanistic models, setting up ODE models, Numerical solution of ODEs.

UNIT II **05**

ANALYSIS OF MODELS: Laplace Transform, circuit analysis with Laplace Transform, Circuit transformation from time to complex frequency, complex impedance, complex admittance, transfer functions, concept of pole and zero, stability, transient analysis , minimum phase and non-minimum phase system, Use of simulation software for electrical system analysis.

UNIT III **05**

CONCEPT OF STATE AND STATE-SPACE BASED MODELING: Linearization of first principle model, Concept of state, state variables, state-space form, state diagram representation, non-uniqueness of state-space model, derivation of state model from different representation of a system, canonical state space models, Examples of state-space modeling of different electrical systems, observability and controllability, derivation of transfer function from state-space and vice versa, state transition matrix, solution of state-space equations, computation of state transition matrix.

UNIT IV **07**

DISCRETE SYSTEM ANALYSIS USING Z-TRANSFORM: Introduction to Discrete systems, sampling, conversion of continuous to discrete state Space models, Introduction to Z-transform, properties of Z-transform.

DATA BASED MODELING TECHNIQUES: Stochastic and statistical properties of the process, different types of regression models, parametric modeling using least square technique, Using system identification as a tool for model building, design of identification experiments, post treatment of data, choice of model structure, Model validation using cross validation concept.

TOTAL HOURS	26

Texts and References:

1. Lennart Ljung, Torkel Glad, "***Modeling of Dynamic System***", Prentice Hall, Englewood Cliffs, NJ, 1994
2. Robert L. Woods and Kent L. Lawrence, "***Modeling and Simulation of Dynamic Systems***", 1st Edition, Prentice Hall, 1997
3. Charles M. Close, Dean K. Frederick, Jonathan C. Newell, "***Modeling and Analysis of Dynamic Systems"***, 3rd Edition, John Wiley and Sons Inc., 2002
4. Steven T.Karris, "***Circuit Analysis II with MATLAB Computing and Simulink/SimPower Systems Modeling***", Orchard Publications, Fremont, California, 2009.
5. Kai Velten, "***Mathematical Modeling and Simulation-Introduction for Scientists and***

Engineers", Wiley-VCH Verlag GmbH and Co. KGaA, 2009.

6 P. P. J. van den Bosch, A. C. van der Klauw, "***Modeling, Identification and Simulation of Dynamical Systems***", CRC Press, 1994.

7 Yucai Zhu, "***Multivariable System Identification for Process Control***", Elsevier Publications, 2001.

8 John Penny, George Lindfield, "***Numerical Methods using MATLAB***", PHI, Upper Saddle River, NJ 2000.

9 Frankline, J. Powelll, Abbas Emami-Naeini, "***Feedback Control of Dynamic Systems***", 5th Edition, Pearson Education, 2006.

EE 314P MODELING AND SIMULATION										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	4	2	4	--	--	--	25	25	50

List of Experiments:

1. Introduction to mathematical computational and simulation software.
2. To study linearization of non-linear systems.
3. Solving ODEs using computational software (Development of Process Simulator).
4. Mathematical model development and simulation of DC Motor using computational software.
5. Introduction to graphical programming.
6. Modeling and simulating, the generation, transmission, distribution, and consumption of electrical power.
7. Experiment based on data based modeling techniques.
8. Mathematical modeling of unstable systems using closed loop identification techniques.
9. Transient analysis of simple RC, RL and RLC circuits.
10. Exposure to circuit analysis tools such as PSpice and Multisim.
11. Introduction to PSCAD for power system analysis and design.
12. To explore LABVIEW as a tool for modeling and simulation.

EE 315T POWER ELECTRONICS										
Teaching Scheme					Examination Scheme					
					Theory			Practical		
L	T	P	C	Hrs/Week	MS	ES	IA	LW	LE/Viva	Total Marks
3	0	--	6	3	30	60	10	--	--	100

UNIT I **11**

POWER SEMICONDUCTOR DEVICES: Power semiconductor devices their symbols and static characteristics, characteristics and specification of switches, types of power electronic circuits operation, steady state and switching characteristics and switching limit of power transistor, operation and steady state characteristics of power MOSFET and IGBT, protection of devices, series and parallel operation of thyristors, commutation technique of thyristor, Thyristor: operation and VI characteristics, two transistor model, methods of turn-on operation of GTO, MCT and TRIAC, Thermal modeling and heat sink calculations, triggering circuits, pulse transformer, optical isolation.

UNIT II **09**

DC TO DC CONVERTERS (CHOPPER): Introduction to DC-DC converter: Principle of Step Down and Step up converter.

PHASE CONTROLLED CONVERTERS: Single phase half wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode. Single phase fully controlled and half controlled bridge converter. Performance parameters of Three phase half wave converters, Three phase fully controlled and half controlled bridge converters, Effect of source impedance Single phase and three phase dual converters.

UNIT III **11**

AC VOLTAGE CONTROLLERS: Principle of On-off and phase controls, single phase AC voltage controller with resistive and inductive loads, three phase ac voltage controllers(various configurations and comparison only), Single phase transformer taps changer.

CYCLO CONVERTERS : Basic principle and operation, single phase to single phase, three phase to single phase and three phase to three phase cyclo converters, output voltage equation.

UNIT IV **08**

INVERTERS: Single phase series resonant inverter, single phase bridge inverters, three phase bridge inverters, voltage control of inverters, harmonics reduction techniques, single phase and three phase current source inverters.

TOTAL HOURS	39

Texts and References:

1. M. H. Rashid, "***Power Electronics: Circuits, Devices and Applications***", Prentice Hall of India Ltd. 3rd Edition, 2004.
2. M. D. Singh and K. B. Khanchandani, "***Power Electronics***", Tata MC Graw Hill, 2005.
3. V. R. Moorthy, "***Power Electroincs: Devices, Circuits and Industrial Applications***", Oxford University Press, 2007.
4. M. S. Jamil Asghar, "***Power Electronics***", Prentice Hall of India Ltd. 2004.
5. Chakrabarti and Rai, "***Fundamentals of Power Electronics and Drives***", Dhanpath Rai and Sons.
6. Ned Mohan, T. M. Undeland and W. P. Robbins, "***Power Electronics: Converters, Applications and Design***", Wiley India Ltd., 2008.
7. S. N. Singh, "***A text book of power electronics***", Dhanpat Rai and Sons.

EE 315P POWER ELECTRONICS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50

List of Experiments:

1. To study the VI characteristics of IGBT, MOSFET, GTO, SCR, TRIAC, DIAC.
2. To study GATE/BASE triggering circuit.
3. Single phase half-wave uncontrolled rectifier with different types of load.
4. Single phase full-wave controlled rectifier with different types of load.
5. Three phase half-wave uncontrolled rectifier with different types of load.
6. Three phase full-wave controlled rectifier with different types of load.
7. Study of Fist quadrant / Type A Chopper with R, R-L and R-L-E load.
8. Study of regeneration with four quadrant chopper.
9. Study of gate triggering circuit for DC-DC converter (Chopper).

EE 316T POWER SYSTEM II										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	--	7	4	30	60	10	--	--	100

UNIT I **10**

REPRESENTATION OF POWER SYSTEM COMPONENTS: Synchronous machines, Transformers, Transmission lines, one line diagram, Impedance diagram, per unit system.

SYMMETRICAL COMONENTS: Symmetrical components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks.

UNIT II **16**

SYMMETRICAL FAULT ANALYSIS: Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machine, internal voltage of loaded machine under transient conditions. **UNSYMMETRICAL FAULT ANALYSIS:** Analysis of single line to ground fault, line to line fault and double line to ground fault on unloaded generators and power system network with and without fault impedance. Formation of Zbus using singular transformation and algorithm, computer method for short circuit calculations.

UNIT III **10**

LOAD FLOW: Introduction, bus classification, nodal admittance matrix(Y Bus), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, approximation to N-R method, line flow equations and Fast decoupled method.

UNIT IV **16**

POWER SYSTEM STABILITY: Stability and stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step-by-step method, Factors affecting steady state and transient stability and method of improvement.

TRAVELLING WAVES: Wave equation for uniform Transmission lines, velocity of propagation, surge impedance, reflection and transmission of travelling waves under different line loadings, Bewlay's lattice diagram, protection of equipments and line against travelling wave.

TOTAL HOURS	**52**

Texts and References:

1. W.D. Stevenson, "***Elements of Power System Analysis***", Mc Graw Hill.
2. C.L. Wadhwa, "***Electrical Power Systems***", New Age International.
3. T.K Nagsarkar and M.S. Sukhija, "***Power System Analysis***", Oxford University Press, 2007.
4. Hadi Sadat, "***Power System Analysis***", Tata McGraw Hill.
5. J.D. Glover, M.S. Sharma and T.J. Overbye, "***Power System Analysis and Design***", Thomson, 2008.
6. Stagg and El-Abiad, "***Computer Methods in Power System Analysis***", Tata Mc Graw Hill.
7. Kothari and Nagrath, "Modern Power System Analysis", Tata Mc Graw Hill.

EE 316P POWER SYSTEM II										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50

List of Experiments:

1 To obtain per unit diagram of various power system configuration.
2 To obtain zero sequence reactance of a transmission line.
3 To study about transient behavior of a 3-phase transmission line.
4 To study about transient behavior or synchronous machine.
5 To perform symmetrical fault analysis.
6 To perform unsymmetrical fault analysis.
7 To obtain Y-bus for given power system configuration.
8 To perform Load Flow using Gauss Siedel method.
9 To perform Load Flow using Newton-Raphson method.
10 To study Transient stability of a power system.

EE 317T INSTRUMENTATION AND CONTROL										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **15**

BASIC CONCEPTS OF MEASUREMENT: Introduction, measurement system, sensors and transducers, basic characteristics of measuring devices, transducer classifications, electrical transducers, basic requirement of transducer.

MEASUREMENT OF DIFFERENT PHYSICAL QUANTITIES: Displacement measurement using potentiometer, speed and vibration measurements, stain gauge, LVDT, Force and pressure measurement using capacitive and piezo-electric transducers, Hall-effect transducer, measurement of temperature using resistance thermometer, thermistors, thermocouples, pyrometer, flow and liquid level transducers.

UNIT II **09**

DATA ACQUISITION AND SIGNAL TRANSMISSION: Signal conditioning of the inputs, data conversion, analog to digital and digital to analog converters, telemetry system, data communication protocols.

RECENT DEVELOPMENTS: Smart Sensors and smart transmitters, computer aided measurements.

UNIT III **10**

PROCESS CONTROL: Principle and elements of process control system, process characteristics, discontinuous control modes, proportional, integral, derivative and composite control modes, PID controller design using analog devices, application of the process control in power plant.

UNIT IV **05**

INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER (PLC): Introduction, PLC architecture, input-output modules, working of PLC, memory mapping, introduction to PLC programming using Ladder Diagrams and function blocks.

TOTAL HOURS	**39**

Texts and References:

1. Ernest O. Doebelin, "***Measurement Systems - Application and Design***", 5th edition, McGraw Hill, 2004.
2. Albert D. Helfrick, William D. Cooper, "***Modern Electronic Instrumentation and Measurement Techniques***", Prentice-Hall India Pvt. Ltd., 2006.
3. A. K. Sawhney, "***Advanced Measurements and Instrumentation***", Dhanpat Rai and Sons.
4. Curtis Johnson, "***Process Control Instrumentation Technology***", 8th Edition, Prentice-Hall.
5. John R. Hackworth, Frederick, D. Hackworth, "***Programmable Logic Controllers: Programming Methods and Applications***", Prentice-Hall, 2003.
6. E. A. Parr, Newnes, "***Programmable Controllers***", 3rd Edition, Reed Educational and Professional Publishing Ltd., 2003.

EE 317P INSTRUMENTATION AND CONTROL										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50

List of Experiments:

1. To compute dynamic characteristics of sensors/transducers.
2. Measurement of displacement using LVDT/Potentiometer.
3. Measurement of force/pressure using strain gauge.
4. Temperature measurement using thermocouple and RTD.
5. Designing PI controller for single board heating system.
6. Implementation of discrete PID controller for coupled tank system.
7. Ladder logic programming on dual conveyor work-cell.
8. Analog to digital and digital to analog conversion using ADC and DAC.
9. PLC ladder programming for traffic light system using PLC simulator.
10. Data acquisition concepts using DAQ hardware and software.