PANDIT DEENDAYAL PETROLEUM UNIVERSITY

SCHOOL OF TECHNOLOGY

COURSE STRUCTURE FOR B.TECH. ELECTRICAL ENGINEEING

SEMESTER IV			**B.TECH. ELECTRICAL ENGINEEING**											
Sr. No	**Course Code**	**Course Name**	**Teaching Scheme**					**Exam Scheme**						
			L	**T**	**P**	**C**	**Hrs/wk**	**Theory**			**Practical**		**Total Marks**
								MS	**ES**	**IA**	**LW**	**LE/Viva**	
1	MA 202T	Numerical Methods	3	1	0	7	4	30	60	10	--	--	100
2	EE 207T	Analog and Digital Electronics	3	0	--	6	3	30	60	10	--	--	100
	EE-207P		--	--	2	1	2	--	--	--	25	25	50
3	EE 208T	Control Theory	3	1	--	7	4	30	60	10	--	--	100
	EE 208P		--	--	2	1	2	--	--	--	25	25	50
4	EE 209T	Communication Engineering	3	0	--	6	3	30	60	10	--	--	100
	EE 209P		--	--	2	1	2	--	--	--	25	25	50
5	EE 210T	Power System I	3	1	--	7	4	30	60	10	--	--	100
	--		--	--	--	--	--	--	--	--	--	--	--
6	EE 211T	Electromechanical Energy Conversion II	3	0	--	6	3	30	60	10	--	--	100
	EE 211P		--	--	2	1	2	--	--	--	25	25	50
		Total	**18**	**3**	**8**	**43**	**29**						800

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

EE 207T ANALOG AND DIGITAL ELECTRONICS										
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**

INTRODUCTION TO OP-AMP: The ideal operational amplifier, Op Amp Characteristics, Differential, inverting and non-inverting amplifier, Practical Op-Amp (input offset voltage, input bias current, input offset current, total output offset voltage, thermal drift, Common Mode configuration and CMRR), Op-Amp with negative feedback (voltage-series and voltage-shunt feedback amplifier), Frequency response of amplifiers.

UNIT II **09**

OP-AMP APPLICATION: DC and AC Amplifiers; Peaking Amplifier; Summing, scaling and averaging amplifier, differential input and differential output amplifier, the integrator and the differentiator, low pass, high pass, band reject, band pass and all pass filter, basic comparator, zero-crossing detector, Schmitt trigger, window detector, voltage limiters, voltage to frequency and frequency to voltage converter, analog to digital and digital to analog converters, Voltage controlled Oscillator, Phase locked loop, Fixed and Adjustable Voltage Regulators, 555 as Astable, Bistable and Monostable multivibrators.

UNIT III **10**

BINARY SYSTEMS, BOOLEAN ALGEBRA AND LOGIC GATES: binary logic, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, digital logic gates, the Map method, four/five variable map, POS simplification, don't care conditions, NAND and NOR implementation, Exclusive OR functions.

COMBINATIONAL LOGIC: Combinational circuit, analysis and design, binary adder - subtractor, decimal adder, binary multiplier, decoder, encoder, multiplexer and de-multiplexers.

UNIT IV **12**

SYNCHRONOUS SEQUENTIAL LOGIC: Sequential circuits, latches, flip-flops, analysis of clocked sequential circuits, design of sequential circuits.

REGISTERS AND COUNTERS: Registers, Shift registers, ripple counter, synchronous counters, ring /Johnson counters.

TOTAL HOURS	**39**

Texts and References:

1. R.A. Gaikwad, "***Operational amplifiers and Linear Integrated Circuits***", Prentice Hall of India.
2. Morris Mano, "***Digital Design***", 3rd Edition, PHI.
3. A.S. Sedra and K.C. Smith , "***Microelectronics Circuits***", Oxford University Press
4. Donald Leach, Albert Malvino, Goutam Saha, "***Digital Principles and Applications***", Tata Mc. Craw Hill.
5. Anand Kumar, "***Switching Theory and Logic Design***", Prentice Hail of India, 2008.

EE 207P ANALOG AND DIGITAL 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. Observing Open-Loop Gain as a function of frequency.
2. Measuring Common Mode Rejection Ratio.
3. To Study Operational Amplifier as Inverting and Non Inverting Amplifier, Voltage Comparator, Integrator and Differentiator.
4. To Study Active Low Pass Filters, Active High Pass Filter, Active Band Pass Filter using Op-Amp.
5. To Study Astable, Mono-stable and Free Running Multi-vibrators using IC 555.
6. To Study Laws and Theorems of Boolean algebra.
7. Study of Logic Gates and Verification of truth tables of Logic gates Using Universal gates (NAND and NOR gates).
8. To verify followings
   - A. Study and verify truth Table of Binary Half Adder
   - B. To study and verify Truth Table of Binary Full Adder (using two half adders).
   - C. Study and verify Truth Table of Binary Half Subtractor
9. Study of Parity Generator/Checker.
10. To study and verify the code conversion circuits.
    - A. Gray to Binary Converter and Binary to Gray Converter
    - B. Studying and verifying BCD to Excess-3 code conversion circuit and prove Truth Table.
11. To verify followings
    - A. To study 4 To 1 Line Multiplexer and 1 To 4 Line De-Multiplexer
    - B. To verify their Truth Table.
12. Study of Encoder and Decoder Circuits
    - A. To study and verify the Truth Table of 8-to-3 Line Encoder.
    - B. To study and verify the Truth Table of 3-to-8 Line Decoder
13. Study of Various types of Flip Flop.
14. Study of Left Right and Programmable Shift Register.
    - A. Study of 4-bit serial in serial out shift register.
    - B. Study of 4-bit serial in parallel out shift register.
    - C. Study of 4-bit parallel in-serial out shift register.
    - D. Study of 4-bit parallel in parallel out shift register.
15. Study of 4 Bit Counters (Synchronous and Asynchronous).
    - A. Study of 4-bit Synchronous Binary up Counter.
    - B. Study of 4-bit Asynchronous Binary up/down counter.

EE 208T CONTROL THEORY										
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 **08**

INTRODUCTION TO CONTROL SYSTEM: Open loop and closed loop systems, examples, components of control systems, types of control systems, concept of feedback, positive and negative feedback.

UNIT II **16**

MATHEMATICAL MODELING OF PHYSICAL SYSTEMS: Modeling of physical systems such as mechanical, electrical, thermal and chemical systems, analogous systems, concept of transfer function, poles, zeros, order and type of the system, computation of overall transfer function, block diagram reduction techniques, signal flow graphs.

TIME RESPONSE ANALYSIS: Standard test signals, transient and steady state response of first and second order systems, time response specifications, steady state error analysis.

UNIT III **20**

STABILITY ANALYSIS OF CONTROL SYSTEMS: Notations of stability, Necessary conditions for stability, Routh-Hurwitz stability criterion, Relative stability, Basic properties of root locus, rules to construct root locus, stability analysis using root locus.

FREQUENCY DOMAIN ANALYSIS: Introduction to frequency response, frequency domain specifications, stability analysis using Bode plots, stability analysis using Polar and Nyquist plots.

UNIT IV **08**

INTRODUCTION TO STATE SPACE: Concept of state, state variables, state space modeling, conversion of state space equations to transfer function, solution of state equation, controllability and observability.

TOTAL HOURS **52**

Texts and References:

1. I.J. Nagrath and M.Gopal, "***Control system Engineering***" , New age International Limited
2. Katsuhiko Ogata, "***Modern Control Engineering***", PHI Learning Pvt. Ltd., New Delhi
3. Gene F. Frankline, J. David Powell, Abbas Emami-Naeini, "***Feedback Control of Dynamic Systems***", Pearson Education Inc., 2006
4. I.J. Nagrath and M.Gopal , "***Systems Modeling and Analysis***", Tata McGraw-Hill Publishing Company Limited

EE 208P CONTROL THEORY										
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. Introduction to Mathematical software-Application in Control Theory.
2. To study Mathematical Modeling of various physical systems such as Coupled tank and Quadruple tank process.
3. To study transient and steady state response of coupled tank system using open loop experimental runs and verify them using open loop simulation .
4. To find Time constant and Steady state gain of Single Board Heating system.
5. To find over all Transfer Function using block diagram and signal flow graphs.
6. To study stability analysis using Root locus.
7. To study stability analysis using Bode plot.
8. To study stability analysis using Polar and Nyquist plots.
9. Mathematical modeling using State Space Technique.
10. To check controllability and observability of linear system.

EE 209T COMMUNICATION ENGINEERING										
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 **08**

SIGNALS AND SPECTRA: Introduction of Communication Systems, Classification of Signals, Signal Operations, Trigonometric and Exponential Fourier Series, Aperiodic signal representation by Fourier Integral, Fourier Transform, Signal Energy and Energy Spectral Density, Signal Power and Power Spectral Density.

UNIT II **12**

AMPLITUDE MODULATION: Amplitude modulation, DSBSC and SSB modulation and demodulation, Generation of Amplitude modulated wave, DSB-SC signal and SSB-SC signal, comparisons of various AM systems.

ANGLE MODULATION: Frequency modulation/demodulation, phase modulation/demodulation, Generation of FM waves, Interference, De-emphasis and Pre-emphasis filtering.

UNIT III **08**

TRANSMITTER AND RECEIVER: Block diagram of AM Transmitter and Receiver, Block diagram of FM Transmitter and Receiver.

NOISE: External noise, internal noise, noise calculations, signal to noise ratio, Noise in AM and FM systems.

UNIT IV **11**

PULSE AND DIGITAL COMMUNICATION: Sampling Process, PAM, PWM, PPM, Elements of digital communication system, Analog to digital and digital to analog conversion, PCM, DPCM, Delta modulation/demodulation, Adaptive delta modulation/demodulation, Digital Modulation and Demodulation Techniques (ASK, PSK, FSK etc.).

TOTAL HOURS	**39**

Texts and References:

1. G. Kennedy and B. Davis, "***Electronic Communication Systems***", Tata McGraw Hill.
2. Simon Haykin, "***Communication Systems***", John Wiley and Sons.
3. Roy Blake, "***Wireless Communication Technology***", Thomson Asia Pvt. Ltd. Singapore.
4. B. P. Lathi, "***Modern Analog and Digital Communication Systems***", Oxford University Press.
5. Taub and Schilling, "***Principles of Communication Systems***", McGraw Hill.
6. P. Chakrabarti, "***A text book of Analog and Digital Communication***", Dhanpat Rai and Co.

EE 209P COMMUNICATION ENGINEERING										
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 examine the waveforms of Amplitude Modulated and Demodulated wave.
2 To examine the waveforms of DSBSC Modulated and Demodulated wave.
3 To examine the waveforms of SSBSC Modulated and Demodulated wave.
4 To examine the waveforms of Frequency Modulated and Demodulated wave.
5 To plot the characteristics of the pre-emphasis and De-emphasis circuit.
6 To study PAM, PWM and PPM.
7 Study of sampling and reconstruction of signal.
8 To study Pulse Code Modulation and Demodulation.
9 To study Amplitude Shift Keying.
10 To study Frequency Shift Keying.

EE 210T POWER SYSTEM I										
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**

INTRODUCTION TO BASIC STRUCTURE OF POWER SYSTEM: Generation, Transmission and Distribution, generating stations, Schematic arrangement, advantages and disadvantages, efficiency, choice of site, types of prime movers, characteristic, speed control and auxiliaries. Environmental aspects for selecting sites and locations for; (a) Steam power station, (b) Hydro power station, (c) Nuclear power station (d) Gas turbine power plant, (e) Combined cycle power plant

UNIT II **16**

OVERHEAD TRANSMISSION LINE: Types of conductors, Calculation of line parameters – Inductance and Capacitance of single phase, three phase, symmetrical and unsymmetrical configurations, Concepts of GMD and GMR, Transposition, Bundle conductors, Double or parallel circuit, Effect of earth on capacitance calculation, Interference with communication circuit, Concept of Corona discharge.

PERFORMANCE OF LINES: Short, medium and long lines - Representation, A, B, C, D constants, Voltage regulation and Transmission efficiency, Ferranti effect.

UNIT III **12**

POWER FLOW THROUGH TRANSMISSION LINE: Mathematical expressions, Effect of active and reactive power flow on bus voltage magnitude and phase angle.

OVERHEAD LINE INSULATORS: Different types, Voltage distribution, String efficiency, Methods of equalizing potential, Insulator failure.

MECHANICAL DESIGN OF OVERHEAD LINES: Sag and tension calculations, Effect of ice and wind, Stringing chart, Sag template, Tower design, Spacing and clearance, Vibration damper.

UNDERGROUND CABLES: Different types, Insulating materials, Dielectric stress, Grading, Capacitance, Heating and causes of breakdown.

UNIT IV **12**

PER-UNIT METHOD OF COMPUTATION: Per-unit quantities, Changing the base of per-unit quantities, Per-unit impedance of single phase and three phase transformers and alternators, Advantages of per-unit method.

POWER SYSTEM GROUNDING OR EARTHING: Equipment grounding, Neutral grounding – Different methods, Grounding transformer. Introduction to EHVAC and HVDC transmission and comparison between them.

TOTAL HOURS	**52**

Texts and References:

1. Sivanagaraju and Satyanarayana, "***Electrical Power Transmission and Distribution***", Pearson Education
2. Glover, Sarma , Overbye, "***Power System Analysis and Design***" Cengage Publication
3. B.A. Oza, "***Power System Generation***"
4. M.V. Deshpande, "***Electrical Power Stations***" PHI Publications
5. Dr. S.L. Uppal, "***Electrical Power***"
6. Soni, Gupta and Bhatnagar, "***A course in electrical power***"

EE 211T ELECTROMECHNICAL ENERGY CONVERSION-II										
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**

ALTERNATOR: Constructional features, armature winding, EMF Equation, Winding coefficients, equivalent circuit and phasor diagram, Armature reaction, O.C. and S.C. tests, Voltage regulation using Synchronous Impedance Method, MMF Method, Potier's Triangle Method, Two reaction theory, Power flow equations of cylindrical and salient pole machines, operating characteristics, active and reactive power delivery capacity curves.

UNIT II **09**

SYNCHRONOUS MOTOR: Operating principle, starting methods, Effect of varying field current at different loads, V-Curves, Hunting and Damping, Synchronous condenser. Parallel Operation of synchronous generators, operation on infinite bus, synchronizing power and torque co-efficient.

UNIT III **11**

THREE PHASE INDUCTION MACHINE: Constructional features, Rotating Magnetic Field, Principle of operation phasor diagram, equivalent circuit, torque and power equations, Torque-Slip Characteristics, no load and blocked rotor tests, efficiency, Induction generator and its applications, Starting, Deep bar and double cage rotors, effect of harmonics, Cogging and Crawling, Speed Control.

UNIT IV **08**

SINGLE PHASE INDUCTION MACHINE: Double revolving field theory, Equivalent circuit, No load and Blocked rotor tests, starting methods, repulsion motor.

SPECIAL PURPOSE MOTORS: Universal motor, single phase AC series compensated motor, stepper motors, Switch Reluctance Motor and Brushless DC motor.

TOTAL HOURS	**39**

Texts and References:

1. D.P. Kothari and I.J. Nagrath, "***Electric Machines***", Tata Mc Graw Hill.
2. Ashfaq Hussain, "***Electric Machines***", Dhanpar Rai and Co.
3. P.S. Bimbhra, "***Electrical Machinery***", Khanna Publishers.
4. P.S. Bimbhra, "***Generalized Theory of Electrical Machines***", Khanna Publishers.
5. M.G. Say, "***Alternating Current Machines***", Pitman and Sons
6. J.B.Gupta, "***Theory and Performance of Electrical Machines***", S.K.Kataria andSons.

EE 211P ELECTROMECHNICAL ENERGY CONVERSION-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. Study and verify the open circuit short circuit characteristic of three phase synchronous generator.
2. Study and verify `V' curve and inverse `V' curve of the three phase synchronous motor.
3. Study and verification of the no load and block load rotor test of three phase induction motor.
4. Study and verification of speed-torque characteristics of three phase induction motor.
5. Study of the running and reversing of three phase induction motor.
6. Study and verify the no load and block load rotor test of single phase induction motor.
7. Study and verify the load test single phase induction motor.
8. Study of the running and reversing of single phase induction motor.