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	0	0	3	3	25	50	25	--	--	100
2	UEE 208T	Analog and Digital Electronics	3	1	--	4	4	25	50	25	--	--	100
3	UEE 209T	Control Theory	3	1	--	4	4	25	50	25	--	--	100
4	UEE 210T	Power System-I	3	1	--	4	4	25	50	25	--	--	100
5	UEE 211T	Electrical Machines-II	4	0	--	4	4	25	50	25	--	--	100
6	UEE 212P	Electrical Machines-II Laboratory	--	--	3	1.5	3	--	--	--	50	50	100
7	UEE 213P	Electronics Laboratory	--	--	3	1.5	3				50	50	100
		Total	**16**	**3**	**6**	**22**	**25**						700

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

Semester IV										
Course Code: UEE 208T					**Course: ANALOG & DIGITAL ELECTRONICS**					
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
3	**1**	**--**	**4**	**4**	**25**	**50**	**25**	**--**	**--**	**100**

Prerequisite: Electronics Devices & Circuits

Course Objectives:

- To enable the students to understand the fundamentals of analog integrated circuits and digital electronics. In addition, the course equips them with the knowledge of basic circuit designing for various applications.
- To provide in-depth knowledge about Digital logic ICs, Combinational and Sequential circuits.
- To emphasize on the significance of low power, small size, reliable, high performance Operational Amplifiers.

UNIT I **08**

INTRODUCTION TO OP-AMP: Introduction to Operational Amplifiers (Op-Amp), Ideal Op-Amp, Op-Amp Characteristics, Differential, Inverting & Non-Inverting Amplifiers, 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 & Voltage-Shunt Feedback Amplifier), Frequency Response of Amplifiers.

UNIT II **09**

OP-AMP APPLICATION: DC & AC Amplifiers, Peaking Amplifier, Summing, Scaling & Averaging Amplifier, Differential Input & Differential Output Amplifier, Integrator & Differentiator, Low Pass Filter, High Pass Filter, Band Reject Filter, Band Pass Filter & All Pass Filter, Basic Comparator, Zero-Crossing Detector, Schmitt Trigger, Window Detector, Voltage Limiters, Voltage to Frequency & Frequency to Voltage Converter, Analog to Digital & Digital to Analog Converters, Voltage Controlled Oscillator, Phase Locked Loop, Fixed & Adjustable Voltage Regulators, 555 Timer as Astable, Bi-Stable & Mono-Stable Multi-Vibrators.

UNIT III **10**

BINARY SYSTEMS, BOOLEAN ALGEBRA AND LOGIC GATES: Binary Arithmetic, Binary Codes, Binary Logic, Basic Theorems & Properties of Boolean Algebra, Boolean Functions, Canonical & Standard Forms, Digital Logic Gates & Their Properties, K-Map Method, Four/Five Variable Map, POS & SOP Simplification, Don't Care Conditions, NAND & NOR Implementation, Exclusive OR Functions.

COMBINATIONAL LOGIC: Combinational Circuit – Analysis & Design, Binary Adder & Subtractor, Decimal Adder, Binary Multiplier, Decoder, Encoder, Multiplexer & De-Multiplexers.

UNIT IV **12**

SYNCHRONOUS SEQUENTIAL LOGIC: Sequential Circuits, Latches, Flip-Flops & Excitation Tables, Analysis of Clocked Sequential Circuits, Design of Sequential Circuits.

REGISTERS AND COUNTERS: Registers, Shift registers, Ripple Counter, Synchronous Counters, Ring/Johnson Counter.

Self-study: The self- study contents will be declared at the commencement of semester.

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***", Prentice Hall of India.
3. A. S. Sedra and K. C. Smith , "***Microelectronics Circuits***", Oxford University Press
4. Donald Leach, Albert Malvino, and Goutam Saha, "***Digital Principles and Applications***", Tata Mc. Craw Hill.
5. Anand Kumar, "***Switching Theory and Logic Design***", Prentice Hail of India

Semester IV										
Course Code: UEE 209T					**Course: CONTROL THEORY**					
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
3	**1**	**--**	**4**	**4**	**25**	**50**	**25**	**--**	**--**	**100**

Course Objectives:

- Introduce to students some real systems, which use automatic control.
- Introduce to students mathematical modeling of physical systems.
- To teach students the characteristics of closed-loop control systems, including steady-state and transient response, disturbances, error, and stability.
- Introduce students to analysis of feedback control systems.
- To impart knowledge in stability analysis of control systems
- To teach students basic control system design methods, including root locus diagrams and frequency response methods.
- Introduce to concept of state and state space models of a system

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 **12**

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 **12**

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 and control design using root locus.

FREQUENCY DOMAIN ANALYSIS: Introduction to frequency response, frequency response specifications, stability analysis using Bode plots, 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	**40**

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.
4. I.J. Nagrath and M.Gopal , "***Systems Modeling and Analysis***", Tata McGraw-Hill Publishing Company Limited.
5. Norman N. Nise, ***"Control system engineering",*** Wiley International Edition.

Semester IV										
Course Code: UEE 210T					**Course: 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**	**--**	**4**	**4**	**25**	**50**	**25**	**--**	**--**	**100**

Course Objectives:

- To enrich the students with the fair knowledge of distribution systems, transmission line parameters, cables, insulators and the recent trends in Transmission and Distribution Systems.
- To understand the various types of transmission and distribution systems
- To analyze the performance of transmission lines.
- To know about the transmission and distribution Substation.

UNIT I **12**

INTRODUCTION TO BASIC STRUCTURE OF POWER SYSTEM: Generation, Transmission & Distribution, Generating Stations, Schematic Arrangement, Advantages & Disadvantages, Efficiency, Choice of Site, Types of Prime Movers & its Characteristic, Speed Control & Auxiliaries, Environmental Aspects For Selecting Sites & 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 & Capacitance of Single Phase and Three Phase Lines, Symmetrical & Unsymmetrical Configurations, Concepts Of GMD & GMR, Transposition, Bundle Conductors, Double or Parallel Circuit, Calculation of Capacitance for 2 Wire & 3 Wire Systems, Capacitance Calculations for Symmetrical & Asymmetrical Single & Three Phase, Single & Double Circuit Lines, Effect of Earth on Capacitance Calculation, Interference with Communication Circuit, Concept of Corona Discharge.

PERFORMANCE OF LINES: Short, Medium & Long Lines - Representation, A, B, C, D Constants, Voltage Regulation & Transmission Efficiency, Ferranti Effect, Surge Impedance & Surge Impedance Loading, Charging Current.

UNIT III **12**

POWER FLOW THROUGH TRANSMISSION LINE: Mathematical Expressions, Effect of Active & Reactive Power Flow on Bus Voltage Magnitude & Phase Angle.

OVERHEAD LINE INSULATORS: Different Types, Voltage Distribution, String Efficiency, Methods of Equalizing Potential, Insulator Failure.

MECHANICAL DESIGN OF OVERHEAD LINES: Sag & Tension Calculations, Effect of Ice and Wind, Stringing Chart, Sag Template, Tower Design, Spacing & Clearance, Vibration Damper.

UNDERGROUND CABLES: Different Types, Insulating Materials, Capacitance of Single & 3-Core Belted Cables, Calculations of Insulation Resistance & Stress in Insulation, Dielectric Stress, Grading, Capacitance Grading, Inter-Sheath Grading, Heating & 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 & Three Phase Transformers & Alternators, Advantages of Per-Unit Method.

POWER SYSTEM GROUNDING OR EARTHING: Equipment Grounding, Neutral Grounding – Different Methods, Grounding Transformer. Introduction to EHVAC & HVDC Transmission & Comparison between them, Electronic grounding, Electric Safety.

Self-study: The self- study contents will be declared at the commencement of semester.

TOTAL HOURS	**52**

Texts and References:

1. Sivanagaraju and Satyanarayana, "***Electrical Power Transmission and Distribution***", Pearson Education.
2. Glover, Sarma , and Overbye, "***Power System Analysis and Design***", Cengage Publication.
3. B. A. Oza, "***Power System Generation***"
4. M. V. Deshpande, "***Electrical Power Stations***", Prentice Hall of India Publications.
5. Dr. S. L. Uppal, "***Electrical Power***"
6. Soni, Gupta and Bhatnagar, "***A course in electrical power***"
7. S. N. Singh, "**Electric Power Generation Transmission and Distribution**," Prentice-Hall of India Pvt. Ltd.
8. Kothari & Nagrath, "Power System Engineering," Tata McGraw-Hill Education, 2008

Semester IV										
Course Code: UEE 211T					**Course: ELECTRICAL MACHINES-II**					
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
4	**0**	**--**	**4**	**4**	**25**	**50**	**25**	**--**	**--**	**100**

Prerequisites : Elements of Electrical Engineering, Electrical Machines-I

Course Objectives:

- To create awareness about the basic principles, fundamental concepts, working and operating characteristics of AC machines, such as Synchronous Machines & Induction machines.
- To understand to their principle of operation, characteristics and testing of Synchronous Machines & Induction machines.
- To understand the performance analysis of different types of Synchronous Machines & Induction machines
- To impart sound knowledge about the different applications of Synchronous Machines & Induction machines

UNIT I **18**

THREE PHASE INDUCTION MACHINES: Classification of AC Motors, Construction & Types, Working Principle, Production of Rotating Magnetic Field, Synchronous Speed, Slip, Frequency of Rotor Current, Torque, Torque/Slip Characteristics, Power Stages, No Load & Blocked Rotor Tests, Phasor Diagram, Equivalent Circuit, Circle Diagram & Determination of Performance Parameters, Deep Bar & Double Cage Induction Motors, Starters For 3-Phase Induction Motors, Methods of Speed Control, Harmonics & its Effects, Cogging & Crawling, Testing of Induction Motor as per IS, Energy Efficient Induction Motors, Induction Generators.

UNIT II 14

ALTERNATOR: Construction, Types, Operating Principle, Generated EMF, Terms Related to AC Armature Winding, Pitch & Distribution Factors, Effect of Harmonics on Induced EMF, Operation on Load, Phasor Diagrams, Power Output Equation, Armature Reaction, SCR of an Alternator. Voltage Regulation, Determination of Voltage Regulation by Direct Loading, Synchronous Impedance, MMF & ZPF Methods, Two Reaction Theory, Parallel Operation, Operation on Infinite Bus, Synchronizing of Alternators & Methods of Synchronization, Slip Test, Hunting of Synchronous Machines & Its Prevention.

UNIT III **08**

SYNCHRONOUS MOTOR: Construction, Operating Principle, Phasor Diagrams, Starting Methods, Effect of Varying Field Current at Different Loads, V-Curves, Hunting & Damping, Synchronous Condenser, Power Developed by Synchronous Motor & Stability.

UNIT IV **12**

SINGLE PHASE INDUCTION MOTORS: Types of Single Phase Motors, Double Field Revolving Theory, Methods of Starting, Equivalent Circuit, No Load & Blocked Rotor Tests, Determination of Equivalent Circuit Parameters, Performance Calculations.

SPECIAL PURPOSE MOTORS: Universal Motor, Single Phase AC Series Motor, Repulsion Motor, Stepper Motors, Permanent Magnet DC Motors, Brushless DC Motors.

Self-study: The self- study contents will be declared at the commencement of semester.

TOTAL HOURS	**52**

Texts and References:

1. D. P. Kothari and I. J. Nagrath, "***Electric Machines***", Tata McGraw Hill.
2. Ashfaq Hussain, "***Electric Machines***", Dhanpat Raiand 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.KatariaandSons.
7. J. G. Jamnani, ***"Electrical Machines"***, Mahajan Publishing House
8. Fitzgerald A.E and Kingsley, Electrical Machinery, Tata McGraw Hill

Semester IV										
Course Code: UEE 212P					**Course: ELECTRICAL MACHINES-II LABORATORY**					
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
--	**--**	**3**	**1.5**	**3**	**--**	**--**	**--**	**50**	**50**	**100**

List of Experiments:

1. To understand the construction and operation of 3-phase induction machine by working cut section.
2. To determine equivalent circuit parameters of a 3-phase induction motor by No load and Blocked rotor test.
3. To determine performance characteristics of 3-phase induction motor using circle diagram.
4. To perform load test on a three phase induction motor.
5. To study different types of starters used for 3-phase induction motors.
6. To determine equivalent circuit parameters of a single phase induction motor by No load and Blocked rotor test.
7. To study starting methods of a single phase induction motor.
8. To perform load test on single phase induction motor.
9. To determine the regulation of an alternator by direct loading method.
10. To determine the regulation of an alternator by synchronous impedance method.
11. To determine the regulation of an alternator by MMF method.
12. To determine the regulation of an alternator by Z.P.F. method.
13. Synchronization of two 3-phase alternators with common bus bars by various methods.
14. To plot `V' curve of the three phase synchronous motor.
15. To determine direct and quadrature axis reactance of a salient pole alternator by slip test.
16. To understand the construction, operating characteristics and speed control of Universal motor.
17. To understand the construction, operating characteristics and speed control of Repulsion motor.
18. To understand the construction, operating characteristics and speed control of PMDC motor.

Semester IV										
Course Code: UEE 213P					**Course: ELECTRONICS LABORATORY**					
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
--	--	3	1.5	3	--	--	--	50	50	100

List of Experiments:

1 Observing Open-Loop Gain of an Operational Amplifier as a function of frequency and measuring Common Mode Rejection Ratio.

2 To Study Operational Amplifier as Inverting and Non Inverting Amplifier, Voltage Comparator, Integrator and Differentiator.

3 To Study Active Low Pass Filters, Active High Pass Filter, Active Band Pass Filter using Op-Amp.

4 To Study Astable, Mono-stable and Free Running Multi-vibrators using IC 555.

5 To Study Laws and Theorems of Boolean algebra.

6 Study of Logic Gates and Verification of truth tables of Logic gates Using Universal gates (NAND and NOR gates).

7 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

8 Study of Parity Generator/Checker.

9 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.

10 To verify followings

- A. To study 4 To 1 Line Multiplexer and 1 To 4 Line De-Multiplexer
- B. To verify their Truth Table.

11 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

12 Study of Various types of Flip Flop.

13 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.

14 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.

15 Study and verification of Diode VI Characteristics.

16 Application of Diode as Clipper and Clamper Circuits.

17 Conversion of A.C. to DC using Diode Rectifier Circuits.

18 Study and verification of Transistor in CB and CE configuration (Input and Output Characteristics).

19 Importance of Biasing of Transistor.

20 Study and experimental verification of Hartley Oscillator and Colpitts Oscillator.