KURUKSHETRA UNIVERSITY KURUKSHETRA

SCHEME OF STUDIES/EXAMINATIONS

Bachelor of Technology (Electrical & Electronics Engineering)

V SEMESTER (w.e.f. 2017-2018)

SN	Course No.	Course Title	Teaching Schedule				Allotment of Marks				Duration of Exam (Hrs)
			L	T	P	Hr/ Wk	Theory	Sessional	Practical	Total	
1	EEN-301N	Power Quality & Management	3	1		4	75	25		100	3
2	EEN-303N	VLSI Design	3	1		4	75	25		100	3
3	EEN-305N	Power Electronics	4	1		5	75	25		100	3
4*	**EE-307N**	Control System	4	1		5	75	25		100	3
5*	**EE-309N**	Power Transmission & Distribution	4	1		5	75	25		100	3
6	EEN-311N	Field & Waves	4	1		5	75	25		100	3
7*	**EE-313N**	Control System Lab			2	2		40	60	100	3
8	EEN-315N	VHDL Lab			2	2		40	60	100	3
9	EEN-317N	Power Electronics Lab			2	2		40	60	100	3
10	EEN-319N	Industrial Training-I	1			1		100		100	
		Grand Total	**23**	**6**	**6**	**35**	**450**	**370**	**180**	**1000**	

Note: 1. * Subjects Common with V Semester. B.Tech. [Electrical Engg.] Scheme, K.U.K.

2. **Industrial Training** undergone by the students after IV sem is to be evaluated during V sem as **(EEN-319N)** through submission of certified computerized report to the H.O.D. followed by conduct of viva-voce & seminar/presentation.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-301N	**Power Quality & Management**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

Unit – I: Power Quality Problems & Monitoring

Overview and Definitions of power quality, sources of pollution, international power quality standards, and regulations.

Unit – II: Power Quality Problems

Surges, voltage sag and swell, over voltage under voltage, outage voltage, and phase angle imbalance, electric noise, harmonics, frequency deviation monitoring.

Unit – III: Power System Harmonics

Harmonic analysis, harmonic sources – the static converters, transformer magnetization and non-linear machines, are furnaces, fluorescent lighting. Harmonic effect within the power system, interference with communication harmonic measurements.

Unit – IV:

Design, measure to minimize the frequency and duration of outages in distribution systems voltage regulators, harmonic filters, power conditioners, uninterruptible power suppliers, emergency and stand by power systems, application of power conditioners. Power distribution systems design, measure to minimize voltage disturbances.

Text Books:

1. N. G. Hingonani, Gyugi, Understanding FACTS concepts, Technology of flexible AC Transmission systems, IEEE Press, 1999

Reference Books:

1. T.J.E Milles , Reactive Power Control in Electric Systems, John Wiley & Sons 1982.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-303N	**VLSI Design**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT I

Introduction: Monolithic Silicon Fabrication Technology: Crystal Growth, Vapour phase (CVDT Technique) and molecular beam epitaxy. Dry and wet Etching.

UNIT II

Diffusion & Oxidation: Oxide properties, oxidation kinetics, Oxidation process, diffusion Fick's law, dopant sources, Diffusion mechanism, Constant source & limited source diffusion, Characterization of diffused layers, Introduction to ion implantation.

UNIT III

Lithography & Metallization: Choice of metals, Vacuum evaporation, Sputtering Metalization problems, Lithography: Introduction to Photo, X-ray, electron beam lithography process, various printing techniques.

UNIT IV

Planer Technology: Fabrication process, Sequence for a BJT, Capacitor, resistor, IC, Environment for IC fabrication,. Assembly & packaging techniques.

Introduction to MOS Technology: Basic MOS transistors, NMOS & CMOS fabrication.

MOS Inverters: Pass Transistor, NMOS Inverter, CMOS Inverter, Latch up in CMOS circuits.

References:

1 K.R. Botkar: Integrated Circuits.
2 S.M. Sze: Micro Electronics.
3 Milliam Grabel : Mico Electronics
4 Pucknell : VLSI Design.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-305N	**Power Electronics**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT I

Introduction: Characteristics of SCR, Diac, Triac and UJT. Protection of SCR against-over voltage, over current, *dv/dt, di/dt*, Heat sink design, Methods of commutation of SCR's, Series and Parallel operation of Thyristors.

UNIT II

AC to DC Converters: Classification of rectifiers, principle of working of each along with control circuits, Analysis of output voltage and current waveforms. Ripple factors, utility factor and efficiency, Effect of source and load inductance, Dual converter.

UNIT III

AC to AC Converters: Classification of Cycloconverters, principle of working along with control circuits, Analysis of output voltage and current waveforms, presence of sub-harmonic in cycloconverter output.

UNIT IV

DC to AC Converters: Classification of inverters, operation of each type, Analysis of voltage and current waveforms, current source inverter, voltage source inverter and pulse width modulated inverter.

DC to DC Converters: Classification of choppers, operating principle and control circuits for each type, Analysis of voltage and current waveforms.

References:

1. Thyrister Engineering by M.S. Brede.
2. Thyrister and their Application by M. Ramamurthy.
3. Thyrister Theory and Applications by Sugandhi and Sugandhi.
4. Principles of Inverter Circuits by B.D. Bedfred and R.G. Hoft.
5. Line Commutated Thyristor Converter by Gotifriend, Moltgen.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-307N	**Control System**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT I

Control Systems: Basics & Components: Introduction to basic terms, classifications & types of Control Systems, block diagrams & signal flow graphs, Mathematical Models of Physical System, Differential equation of physical systems & electrical systems with analogy. Transfer function, determination of transfer function using block diagram reduction techniques and Mason's Gain formula. Error detectors, Signal conditioners, Modulators, Demodulators, Servo amplifiers voltage and power, Actuators including servomotors, Techogenerators, Stepper motor.

UNIT II

Time–Domain Analysis :Time domain analysis, transient response of first & second order systems ,steady state error and static error constants in unity feedback control systems, response with P, PI and PID controllers, limitations of time domain analysis.

UNIT III

Frequency Domain Analysis and Stability : Concept of stability, graphic and numeric techniques of stability analysis, Routh Hurwitz, Nyquist, Bode plot, Root locii and polar plots, frequency domain specifications and performance of LTI systems, Gain and phase margins, relative stability. Correlation with time domain performance closed loop frequency responses from open loop response. Limitations of frequency domain analysis.

UNIT IV

State Space & Compensation Techniques: State space characteristics of control systems. Concepts of state variable, Transfer Function controllability and observability. Concepts of compensation, series/parallel/ series-parallel/feedback compensation, Lag/Lead/Lag-Lead networks for compensation.

References :

1. Control System Engg. By Nagrath and Gopal.
2. Control System Engg. By K.Ogata.
3. Liner Control System by R.S. Chauhan, (Umesh Publications)
4. Feedback control system Analysis and Synthesis by D'Azzo and Houpias.
5. Control System by B.C. Kuo.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-309N	**Power Transmission & Distribution**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT- I

Transmission of Power by A.C. & D.C. system: Typical power system, Modern trends in power system transmission . Underground and overhead system, Effects of increase in Voltage on transmission line efficiency
Distribution of Power: General consideration, Radial and ring main system. Different types of distributors; Relative copper consumption in various systems. Conductor size and Kelvin's Law, Tariffs and power factor improvement.

UNIT- II

Resistance of transmission lines, skin effects, Proximity effect,
Inductance of a single phase & two phase line, Composite conductor lines, Three phase lines with symmetrical and unsymmetrical spacing, , Bundled conductors
Capacitance of two-wire line, three phase line with symmetrical and unsymmetrical spacing, Effect of earth capacitance.

UNIT- III

PERFORMANCE OF LINES Short, medium and long lines – their representation, Performance calculation, determination of ABCD parameters, Ferranti effect, Surge impedance Loading of transmission lines, , Calculation of synchronous phase modifier capacity.
Corona loss & radio interference Factors affecting corona , advantages and disadvantages of corona, disruptive critical voltage, visual critical voltage, corona power loss, methods of reducing corona effects, advantages & disadvantages of corona, interference of power lines with neighboring communication lines.

UNIT IV

Underground cables, Cables for A.C & D.C systems, Insulation resistance and capacitance, capacitance measurement, cable loss, Power factor in cable. Heating of cables Thermal characteristics, Use of inter sheaths, Capacitance grading.

Mechanical Considerations Types of Insulators, Methods of equalizing voltage distribution, Line supports, various types of conductor material, Sag calculations, Effect of wind, Ice and temperature on sag, Conditions at erection.
Text Books/References:

1. Power System analysis and Stability by S.S. Vadhera
2. Electrical Power System by C.L. Wadhwa
3. Electrical Power System by Ashfaq Hussain
4. Elements of Power System Analysis by W.D. Stevenson
5. Electric Power System by B.M. Weddy
6. The transmission and Distribution of Electric energy by H. Cotton
7. Modern Power System Analysis by I.J. Nagrath and D.P. Kothari
8. A Course in Electrical Power by Soni, Gupta and Bhatnagar

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-311N	**Field & Waves**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT – 1

Review of vector algebra, the three orthogonal co-ordinate systems and their inter-relation, review of vector calculus in all the three coordinate systems: Line, surface & volume integrals, gradient, divergence & curl of vector & their physical significance, Divergence theorem, stokes theorem, concept of soleniodal and irrotational fields.

Gauss Law in electrostatics & its applications, uniform line, surface & volume charge distributions, concept of electric field & electric potentials, electric field & potential due to a linear dipole, Spherical & cylindrical capacitor, energy density in electric field, method of images.

UNIT-II

Magnetostatics: Magnetic flux density and magnetizing field intensity, Biot Savart's law, Amperes circuital law & its applications. Magnetic vector potentials, Magnetic field energy, boundary conditions for both the electric & magnetic fields at the interface of various types of media. Laplace, Poisson's equation & continuity equation, displacement current density, conduction current density, Maxwell's equation in differential & integral forms, time harmonic cases & their physical significance, retarded potentials.

UNIT- III

UPW: Plane waves & uniform plane waves and their properties , wave equations in various media, Polarization & its types, intrinsic impedance, propagation constant, reflection & refraction of uniform plane waves at the interface of conductor- dielectric & dielectric-dielectric (both normal and oblique incidence). Relaxation time, skin effect, skin depth & surface impedance, Poynting vector theorem and its physical significance.

UNIT- IV

Transmission lines: Distributed parameters, circuit parameters, concepts of voltage & current flow on a transmission line, line equations, characteristics impedance. Reflection of transmission line, maxima & minima, standing wave ratio of a transmission line, impedance matching, Smith's chart & its applications, co-axial type transmission line.

Wave Guides: Brief idea of Wave Guides, types of Wave Guides. TE, TM and TEM modes in rectangular wave guides.

Reference Books:

1. Field & Waves Electromagnetic by D.K. Cheng. (Pearson Education)
2. Electromagnetic Fields & Wave by Sadiku (Oxford Univ. Press)
3. Electromagnetic by J.D. Kraus, MGH.

Code	Nomenclature of Lab	P	Int.	Ext.	Total	Time
EE-313N	**Control System Lab**	**2**	**40**	**60**	**100**	**3 Hr**

LIST OF EXPERIMENTS:

1. Experiment to study linear system simulator.
2. To study the stroboscope & measure the shaft speed
2. Experiment to study light intensity control using P & PI controller with provision for and transient speed control.
3. Experiment to study D.C motor speed control.
4. Experiment to study the stepper motor characteristics and its control through microprocessor kit.
5. Experiment to study Temperature control system.
6. Experiment to study Compensation design.
7. Experiment to study Digital control system.
8. Experiment to study synchros.
10. Experiment to study AC Position control system.
11. Experiment to study Potential Metric Error detector.

NOTE: 10 experiments are to be performed with at least 8 from above list; the remaining may either be performed or designed & set by concerned Institution as per the scope.

Code	Nomenclature of Lab	P	Int.	Ext.	Total	Time
EEN-315N	**VHDL Lab**	**2**	**40**	**60**	**100**	**3 Hr**

LIST OF EXPERIMENTS

1. Study of VHDL.
2. To design the two input NAND gate , NOR gate , EX-OR gate in VHDL .
3. To design a full adder & full subtractor using the same hardware & with the help of control signal.
4. To design a 4:1 multiplexer and 1:4 demultiplexer in VHDL.
5. To design a priority encoder in VHDL
6. To design a carry look ahead adder in VHDL.
7. To design a BCD adder & BCD subtractor in VHDL.
8. Write a program in VHDL to compute 2's complement of a four bit binary numbers.
9. Write a program in VHDL to implement the Boolean expression . F= (A+ B) (C+D) using CMOS circuitry .
10. Implement a F= (A+ B) using only PMOS circuitry.
    (i) Design a MOD-6 synchronous & asynchronous (ripple) counter in VHDL.
    (ii) Design a MOD-8 ring & Johnson counter in VHDL.
11. How to Install the VHDL on Computers for VLSI programs

NOTE: Ten experiments are to be performed, out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution.

Code	Nomenclature of Lab	P	Int.	Ext.	Total	Time
EEN-317N	**Power Electronics Lab**	**2**	**40**	**60**	**100**	**3 Hr**

LIST OF EXPERIMENTS

1. To plot the firing characteristics of given silicon control rectifier.
   (A) By varying the gate current I_g keeping forward voltage V_{ak} fixed.
   (B) By varying forward voltage V_{ak} keeping gate current fixed
2. To study the V-I characteristics of given UJT (2n2646)
3. To plot V-I characteristics of given Triac in I and III quadrant.
4. To plot the drain characteristics of given FET & to evaluate the parameter RD, IDSS.
5. To study the UJT based relaxation Oscillator and to evaluate the dynamic resistance.
6. To study and draw the characteristics of DC-DC Chopper power circuit.
7. To study the characteristics of Single Phase fully controlled converter circuit.
8. To study the characteristics of 3-Phase Fully controlled power circuit.
9. To study Single Phase Cycloconverter circuit.
10. To study 3-Phase half wave rectifier using MAT LAB.

NOTE: Ten experiments are to be performed, out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution.