UTTAR PRADESH TECHNICAL UNIVERSITY
LUCKNOW

Syllabus

Bachelor of Electrical and Electronics Engineering

4th Year (VII & VIII Semester)

(Effective for Session 2015-16)

STUDY AND EVALUATION SCHEME OF ELECTRICAL & ELECTRONICS ENGINEERING

Final Year

Semester-VII

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				SUBJECT TOTAL	CREDIT
						Sessional Assessment			ESE		
			L	T	P	CT	TA	TOTAL			
THEORY SUBJECTS											
1	EOE-071 EOE-074	Open Elective-I	3	1	0	30	20	50	100	150	4
2	EEE-031 EEE-034	Departmental Elective-III	3	1	0	30	20	50	100	150	4
3		Departmental Elective-IV	3	1	0	30	20	50	100	150	4
4	EEE-701	Switch Gear & Protection	3	1	0	30	20	50	100	150	4
5	EEN-701/ EEE-504	Electrical Instrumentation & Process Control	3	1	0	30	20	50	100	150	4
6	EHU-111	*Human Values & Professional Ethics	2	2	0	15	10	25	50	75	-
PRACTICAL / DESIGN / DRAWING											
7	EEE-751	Power System Lab	0	0	3	10	10	20	30	50	1
8	EEN-751/ EEE-553	Electrical Instrumentation Lab	0	0	2	10	10	20	30	50	1
9	EEN-753	Project	0	0	3	-	50	50	-	50	2
10	EEN-754	Industrial Training	0	0	2	-	-	50	-	50	1
11	GP-701	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**15**	**7**	**10**	**170**	**170**	**440**	**560**	**1000**	**26**

*Human values & Professional Ethics /Cyber Security will be offered as a compulsory audit course for which passing marks are 30% in End Semester Examination and 40% in aggregate.

STUDY AND EVELUATION SCHEME OF ELECTRICAL & ELECTRONICS ENGINEERING

Final Year

Semester-VIII

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
						Sessional Assessment			ESE		
			L	T	P	CT	TA	TOTAL			
THEORY SUBJECTS											
1	EOE-081 EOE-084	Open Elective-II	3	1	0	30	20	50	100	150	4
2	EEE-051 EEE-054	Departmental Elective-V	3	1	0	30	20	50	100	150	4
3		Departmental Elective-VI	3	1	0	30	20	50	100	150	4
4	EEC-809	Data Communication Networks	3	0	0	30	20	50	100	150	3
5	EHU-111	*Human Values & Professional Ethics	2	2	0	15	10	25	50	75	-
PRACTICAL / DESIGN / DRAWING											
6	EEN-801	Project	0	0	12	-	100	100	250	350	8
7	GP-801	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**12**	**5**	**12**	**120**	**180**	**350**	**650**	**1000**	**24**

DEPARTMENTAL ELECTIVE

ELECTIVE – III

ECS-039 Object Oriented Systems and C^{++}
EEE-031 Power System Operation & Control
EEE-032 Advanced Microprocessor and Microcontroller
EEE-033 Electric Drives

ELECTIVE – IV

EEC-046 Telemetry & Data Transmission
EEC-047 Embedded System
EEC-048 Digital System Design Using VHDL
EEC-049 Optical Fiber Communication

ELECTIVE – V

EEE-051	Bio Instrumentation
EEE-052	Advanced Control System
EEE-053	Reliability Engineering
EEE-054	Energy Efficiency & Conservation

ELECTIVE-VI

EEC-066	Microwave & Radar
EEC-067	Speech Processing
EEC-068	Image Processing
EEC-069	Satellite Communication

OPEN ELECTIVES

OPEN ELECTIVE-I

EOE-071	Entrepreneurship Development
EOE-072	Quality Management
EOE-073	Operations Research
EOE-074	Introduction to Biotechnology

OPEN ELECTIVE-II

EOE-081	Non Conventional Energy Resources
EOE-082	Nonlinear Dynamics Systems
EOE-083	Product Development
EOE-084	Automation & Robotics

*Human values & Professional Ethics /Cyber Security will be offered as a compulsory audit course for which passing marks are 30% in End Semester Examination and 40% in aggregate.

VISION

To achieve excellence in imparting education in the field of electrical and electronics engineering by creating competent professionals for industry and socio economic development to meet national and international needs.

MISSION

To provide students with supportive environment that facilitates learning to solve the problems in the field of electrical and electronics engineering and to prepare them to be successful and ethical human beings as well as professionals as they move to industry academia and other professions.

PROGRAM EDUCATIONAL OBJECTIVES

There are following Program Educational objectives:

1) To educate students in mathematical, scientific, electrical and electronics engineering concepts necessary to formulate, analyze and solve engineering problems faced by society.

2) To prepare students to communicate effectively, work harmoniously in teams with professional ethics and learn to adopt an integrated approach to problems in the field of electrical and electronics engineering by using latest and advanced technology tools.

3) To prepare students to have broad understanding of the engineering and management principles and apply the acquired knowledge in solving complex and multidisciplinary engineering problems.

4) To equip students with the knowledge to design and develop engineering solutions to the problems faced by society for its sustainable development with the help of environment friendly technologies.

5) To inculcate the ability among the students to explore and learn by themselves, the changes taking place continuously in the field of engineering and technology as part of lifelong learning process.

PROGRAM OUTCOME

There are following Program outcomes:

(a) Apply knowledge of mathematics, science, and electrical & electronics engineering.

(b) Identify, formulate, and solve electrical & electronics engineering problems

(c) Design and conduct experiments of electrical & electronics engineering, as well as to analyze and interpret data

(d) Design an electrical & electronic system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(e) Use the techniques, skills, and modern engineering tools necessary for electrical & electronics engineering practice.

(f) Understand the impact of electrical & electronics engineering solutions in a global, economic, environmental, and societal context

(g) Understand professional and ethical responsibility, while pursuing engineering practices.

(h) Visualize and work in laboratory and understanding of individual and team responsibilities, also imparting knowledge of contemporary issues.

(i) Communicate effectively on complex engineering activities with engineering community and with society at large.

(j) Demonstrate the knowledge and understanding of management principles and to function on multidisciplinary teams

(k) Recognize the need for, and an ability to engage in lifelong learning.

EOE-072: QUALITY MANAGEMENT

L T P 3 1 0

1. Preamble: QM is a method of quality control that has been lauded as a generic paradigm for managing complex quality control issues. The idea is managing complex and convoluted interactions and procedures within a company by breaking the process down to more manageable component parts is mechanistic in its approach and appealing to those that equate process to a linear sequence of events.

2. Course Educational Objective :

1. To understand the Quality Management concept and principles and the various modern tools available to achieve Quality Management, Quality of Manufacturing.
2. To understand the statistical approach for quality control. To understand the various models of TQM, Human factor in Quality, process management, total employees involvement.
3. To understand the concept of Quality Control Charts and their attributes.
4. To understand the methods of defects diagnosis and prevention study, MTTF and other reliability concepts.
5. To understand the ISO-9000 series in Quality management and JIT Methods.

3. Course Outcomes:

1.Explain the concept of quality, total quality management.
2. Demonstrate the Philosophies of quality management
3. Apply the concepts of SPC and process capability
4. Design and implement tools for Quality management
5. Demonstrate the importance of customer and various problem solving skills.

4. Pre-requisites:

1.Communicative in English, Industrial Management, Human Behavior.
2.Communicative in English- EME, Human Values.

5. Link to other courses:

1. Mini Projects
2. Projects

6. Course Content:

UNIT-I

Quality Concepts:

Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type.

Control on Purchased Product

Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality

Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

UNIT-II

Quality Management

Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program.

Human Factor in quality

Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods

UNIT-III

Control Charts

Theory of control charts, measurement range, construction and analysis of R charts, process Capability study, use of control charts.

Attributes of Control Chart

Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

UNIT –IV

Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

UNIT –V

ISO-9000 and its concept of Quality Management

ISO 9000 series, Taguchi method, JIT in some details.

Text / Reference Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.

2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.

3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

EEE-033: ELECTRIC DRIVES

L T P 3 1 0

1. Preamble: This course on Electric Drive provides fundamental concepts of classical electric drive in terms of selection, operation and control. Besides classical drives the subject also provides knowledge on the power electronic or solid state controlled DC and AC drives.

2. Course Educational Objective:

1. To understand the criteria of motor selection for a particular industrial application.
2. To study the different types electrical braking used in DC and AC motors.
3. To study and learn the operation of chopper and converter controlled DC drive.
4. To understand the differences between synchronous motor drive and induction motor drive and to learn the basics of permanent magnet synchronous motor drives.
5. To understand the construction and operation of special types of machines such as

3. Course Outcome: On successful completion of this course

1. Student will be able to do the thermal modeling of motor for a particular duty of application and select the motor for a particular application.
2. Student will be able to design the electrical braking system of motors.
3. Student will be able to understand the operation of the converter / chopper fed dc drive and to solve simple problems.
4. Student will be able to understand the concept of AC and DC drive system.
5. Student will understand the operation of special electrical drives and suggest their use in different special applications such as robotics, process industry, and aeronautics.

4. Pre-Requisite:

1. Knowledge on Electrical machines.
2. Knowledge on Power Electronics converters.

5. Links to Other Courses:

1. This course will be helpful in understanding the Basic concepts of Semiconductor controlled electric drive.
2. This course will also form the base to understand courses on Stepper motor and special electrical machines.

6. Course Content:

Unit - I

Fundamentals of Electric Drive: Electric Drives and its parts, advantages of electric drives. Classification of electric drives. Speed - torque conventions and multi-quadrant operations. Constant torque and constant power operation, Types of load, Load torque: components, nature and classification.

Selection of Motor Power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty, Load equalization.

Unit - II

Dynamics of Electric Drive: Dynamics of motor-load combination, Steady state stability of Electric Drive.

Electric Braking: Purpose and types of electric braking, braking of dc, three phase induction and synchronous motors.

Unit - III

Power Electronic Control of DC Drives: Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only), dual converter fed separately excited dc motor drive, rectifier control of dc series motor. Supply harmonics, power factor and ripples in motor current. Chopper control of separately excited dc motor and dc series motor.

UNIT IV & V

Power Electronic Control of AC Drives: Three Phase induction Motor Drive: Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo - converter based) static rotor resistance and slip power recovery control schemes.

Three Phase Synchronous motor: Self controlled scheme.

Special Drives: Switched Reluctance motor, Brushless dc motor. Selection of motor for particular applications.

Text Books:

1. Dubey, G.K., "Fundamentals of Electrical Drives", 2nd Edition, Narosa Publishing House,2001.
2. Pillai, S.K., "A First Course on Electrical Drives", Wiley Eastern Limited, 1993.

References Book:

1. Bimal K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, 2002.
2. Krishnan, R., "Electric Motor and Drives Modelling, Analysis and Control", Prentice Hallof India, 2001.
3. VedamSubrahmanyam.,"Electrical Drives",TataMcGraw-hill Publishing company limited,1994.
4. Gopal K.Dubey.,"Power semiconductor Controlled Drives",Prentice Hall,1989.

EEC-047: EMBEDDED SYSTEM

L T P 3 1 0

1. PREAMBLE: The subject deals with embedded systems, its hardware, software, devices and buses used for embedded networking.

2. COURSE EDUCATIONAL OBJECTIVES

This course is intended

1. To introduce students to the embedded systems, its hardware and software.
2. To introduce devices and buses used for embedded networking.
3. To explain real time operating systems, inter-task communication, Microprocessor
4. To know interfacing I/O Addressing, Direct memory access, Arbitration, multilevel bus architecture etc.

3. COURSE OUTCOMES

Students undergoing this course will be able to

1. Apply computing principles in emerging technologies and applications for embedded systems.
2. Discuss and formulate the concepts of Processors, ASIPs, DSP chips etc.
3. Use the techniques and skills to understand the features related to Embedded versus external memory devices, CISC and RISC processors, Harvard and Von Neumann Architectures.
4. Visualize and understand Advanced processor Architectures of 80386, 80486 and ARM.
5. Recognize the need for serial, parallel and wireless protocols, to indulge in Real world Interfacing so as to engage in lifelong learning

4. PRE-REQUISITE

Microprocessor, Microcontroller, Computer Organization.

5. LINKS TO OTHER COURSES

Project

6. COURSE CONTENT

Unit-I

Introduction:

1. Embedded systems and its applications, Embedded Operating system, Design parameters of an embedded system and its significance, design life cycle, tools introduction, hardware and software partitioning and co-design.

2. Hardware Fundamentals for the embedded developers Digital circuit parameters Open collector outputs Tristate outputs I/O sinking and Sourcing, PLD's, Watchdog Timers, Hardware design and development.

3. **Custom Single Purpose Processors:** Optimizing program, FSMD, Data path & FSM.

4. **General purpose processors and ASIP's (Application Specific Instruction set Programming):** Software and operation of general purpose processors-Programmers View Development Environment-ASIPs Microcontrollers-DSP Chips.

Unit-II & III

Introduction to Microcontrollers and Micoprocessors, Embedded versus external memory devices, CISC and RISC processors, Harvard and Von Neumann Architectures.

8051 Microcontrollers-Assembly language, architecture, registers, Addressing modes, Instruction set, I/O ports and memory organization Interrupts Timer/counter and serial communication.

Unit-IV

RTOS-Tasks, states, Data, Semaphores and shared data, Operating system services, Message queues, Mailboxes.

Advanced Processor-(only architectures) 80386, 80486 and ARM (References)

Unit-V

Communication basics, Microprocessor Interfacing I/O Addressing, Direct memory access, Arbitration, multilevel bus architecture, Serial protocols, Parallel protocols and wireless protocols.

Real world Interfacing: LCD, Stepping Motor, ADC, DAC, LED, Push Buttons, Key board, Latch Interconnection, PPI.

Text Books:

1. Embedded System Design-Frank Vahid/Tony Givargis, John Willey@2005.
2. Microcontroller (Theory and Applications) Ajay V Deshmukh,Tata McGraw-Hill@2005.
3. An Embedded Software Primer-David E.Simon, Pearson Education @ 1999.

References:

1. The 8051 Microcontroller and embedded systems-Muhammad Ali Mazidi and Janice Gillispie.
2. Microcontrollers (Architecture, Implementation & Programming) Kenneth Hintz, Daniel Tabak, Tata McGraw-Hill@2005.
3. 8051 Microcontrollers & Embedded Systems 2nd Edition-Sampath Kr, Katson Books@2006. [52] EEC–048: DIGITAL SYSTEM DESIGN USING VHDL
4. Rajkamal, 'Embedded System – Architecture, Programming, Design', Tata McGraw Hill, 2003.
5. Daniel W. Lewis 'Fundamentals of Embedded Software', Prentice Hall of India, 2004**.**
6. Sriram V. Iyer, Pankaj Gupte, 'Embedded Real Time Systems Programming', Tata McGraw Hill, 2004.
7. Steve Heath, 'Embedded System Design', II edition, Elsevier, 2003

EEE-701: SWITCHGEAR & PROTECTION

L T P 3 1 0

1. Preamble: This course, Switchgear & Protection provides knowledge for the switching devices that form the backbone of modern electrical distribution systems. It provides basic design, operation, and protection of switchgears, including circuit breakers, transformers, relays, switches, and fuses.

2. Course Educational Objectives:
To introduce the application of power system protection and switchgear

3. Course Outcomes:
1. Knowledge on various earthing practices usage of symmetrical components to
2. Estimate fault current and fault MVA.
3. Study of Relays & Study of protection scheme, solid state relays.
4. To understand instrument transformer and accuracy.
5. To understand the method of circuit breaking various arc theories Arcing phenomena –
6. capacitive and inductive breaking.
7. Types of circuit breakers.

4. Pre-requisites:
1. Power System Analysis
2. Power Systems

5. Link to other courses:
1. Provides an extensive knowledge to pursue higher education on Power System.

6. Course Content:

Unit I:

Introduction to Protection System:
Introduction to protection system and its elements, functions of protective relaying, protective zones, primary and backup protection, desirable qualities of protective relaying, basic terminology.

Relays:
Electromagnetic, attracted and induction type relays, thermal relay, gas actuated relay, design considerations of electromagnetic relay.

Unit-II:

Relay Application and Characteristics:
Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relay

Static Relays:
Comparison with electromagnetic relay, classification and their description, over current relays, directional relay, distance relays, differential relay.

Unit-III

Protection of Transmission Line:
Over current protection, distance protection, pilot wire protection, carrier current protection, protection of bus, auto re-closing,

Unit-IV:

Circuit Breaking:
Properties of arc, arc extinction theories, re-striking voltage transient, current chopping, resistance switching, capacitive current interruption, short line interruption, circuit breaker ratings.

Testing Of Circuit Breaker:
Classification, testing station and equipments, testing procedure, direct and indirect testing

Unit-V

Apparatus Protection:
Protection of Transformer, generator and motor.

Circuit Breaker:
Operating modes, selection of circuit breakers, constructional features and operation of Bulk Oil, Minimum Oil, Air Blast, SF6, Vacuum and d. c. circuit breakers.

TEXT BOOKS:
1. B.Ravindranath and N.Chander, "Power Systems protection and switchgear", Wiley Eastern Ltd, 1977.
2. Badri Ram and Viswakarma, D.N., “Power System Protection and Switch Gear”, Tata McGraw-Hill Publishing Company Ltd., 2001.

REFERENCE BOOKS:
1. C.L.Wadhwa, " Electric power systems", New Age International (P) Ltd publishers, 1983.
2. S.P.Patra, S.K.Babu and S.Choudhuri, "Power systems protection", Oxford and IBM Publishing Co., 1983.
3. Sunil S. Rao, "Switchgear and protection", Khanna publishers, New Delhi, 1986.
4. Lewis Blackburn “Protective Relaying – Principles and applications”, Second Edition, Dekker Inc., 1998.
5. T.S.Madhava Rao, “Solid State Relays”, Tata McGraw Hill

EEN-701: ELECTRICAL INSTRUMENTATION & PROCESS CONTROL

L T P 3 1 0

1. Preamble: Instrumentation can be described as "the art and science of measurement and control". It is the technology of measurement that services not only physical, chemical and biological sciences; but also all branches of engineering and medicine. This course provides the knowledge of various types of transducers used in industries, various methods used for transmission of data measured in industries, process control and various types of display devices & recorders.

2. Course Educational Objectives

1. To enrich the students to acquire knowledge about various types of transducers, their construction and functioning.
2. To provide the students' knowledge of various types of data/ information transmission methods and different types of display devices & recorders.

3. Course Outcomes: On successful completion of this course students will be able to:

1. Study electrical transducers, classification, characteristics, and factors affecting the choice of transducers to identify, formulate and solve engineering problems.
2. Design and conduct experiments of Capacitive, Piezoelectric, Hall effect and opto electronic transducers to meet desired needs within realistic constraints.
3. Study general telemetry system, land line and radio frequency telemetering system and transmission channels considering their impact in global context.
4. Learn display devices, storage oscilloscope, spectrum analyzer, strip chart and xy recorders, magnetic tape and digital tape recorders and recognize their need in life.
5. Study computer aided measurements, fiber optic transducers, micro sensors, smart sensors, and smart transmitters. Also Learn proportional (P), integral (I), Derivative (D), PI, PD and PID control modes electronic, pneumatic & digital controllers.

4. Pre-Requisites:

1. Knowledge of physics & chemistry.
2. Knowledge of Basic Electrical and Electronics Engineering

5. Links to Other Courses

1. Electrical measurements and measuring instruments.
2. Biomedical instrumentation.
3. Analog and digital communication.

6. Course Content

Unit-I:

Transducer – I:
Definition, advantages of electrical transducers, classification, characteristics, factors affecting The choice of transducers, Potentiometers, Strain guages, Resistance thermometer, Thermistors, Thermocouples, LVDT,RVDT

Unit-II

Transducer – II :
Capacitive, Piezoelectric Hall effect and opto electronic transducers. Measurement of Motion, Force pressure, temperature, flow and liquid level.

Unit-III:

Telemetry:
General telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter.

Data Acquisition System:
Analog data acquisition system, Digital data acquisition system, Modern digital data acquisition system.

Unit-IV:

Display Devices and Recorders:
Display devices, storage oscilloscope, spectrum analyzer, strip chart & x-y recorders, magnetic tape & digital tape recorders.

Recent Developments:
Computer aided measurements, fibre optic transducers, microsessors, smart sensors, smart transmitters.

Unit-V:

Process Control :
Principle, elements of process control system, process characteristics, proportional (P), integral (I), Derivative (D), PI, PD and PID control modes. Electronic, Pneumatic & digital controllers.

Text Books:
1. A.K.Sawhney, "Advanced Measurements & Instrumentation", DhanpatRai & Sons
2. B.C. Nakra & K.Chaudhry, "Instrumentation, Measurement and Analysis", Tata McGraw Hill 2nd Edition.
3. Curtis Johns, "Process Control Instrumentation Technology", Prentice Hall
4. Patranabis "Telemetry principles", Tata Mcgraw hills
Reference Books:
1. E.O. Decblin, "Measurement System – Application & design", McGraw Hill.
2. W.D. Cooper and A.P. Beltried, "Electronics Instrumentation and Measurement Techniques" Prentice Hall International
3. RajendraPrasad,"Electronic Measurement and Instrumentation Khanna Publisher
4. M.M.S. Anand, "Electronic Instruments and Instrumentation Technology" PHI Learning.

EEE-751: POWER SYSTEM LAB

L T P 0 0 2

Note: - At least 10 experiments should be performed out of which 3 should be simulation based.

(A) Hardware Based:

1. To determine direct axis reactance (x_d) and quadrature axis reactance (x_q) of a salient pole alternator.
2. To determine negative and zero sequence reactances of an alternator.
3. To determine sub transient direct axis reactance (x_d) and sub transient quadrature axis reactance (x_q) of an alternator.
4. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation.
5. To study the IDMT over current relay and determine the time current characteristics
6. To study percentage differential relay
7. To study Impedance, MHO and Reactance type distance relays
8. To determine location of fault in a cable using cable fault locator
9. To study ferranty effect and voltage distribution in H.V. long transmission line using transmission line model.
10. To study operation of oil testing set.

(B) Simulation Based Experiments (using MATLAB or any other software)

1. To determine transmission line performance.
2. To obtain steady state, transient and sub-transient short circuit currents in an alternator
3. To obtain formation of Y-bus and perform load flow analysis
4. To perform symmetrical fault analysis in a power system
5. To perform unsymmetrical fault analysis in a power system

Text Books:-

1. Hasdi Sadat, "Power System Analysis" Tata Mc.Graw Hill.
2. T. K. Nagsarskar & M.S. Sukhija,' Power System Analysis' Oxford Universitry Press.

EEN-751: ELECTRICAL INSTRUMENTATION LAB

L T P 0 0 2

Note: Minimum ten experiments should be performed from the following

1. Measurement of displacement using LVDT.
2. Measurement of displacement using strain gauge based displacement transducer.
3. Measurement of displacement using magnetic pickup.
4. Measurement of load using strain gauge based load cell.
5. Measurement of water level using strain gauge based water level transducer
6. Measurement of flow rate by anemometer
7. Measurement of temperature by RTD.
8. Measurement of temperature by thermocouple
9. Study of P,PI and PID controllers
10. Study of storage oscilloscope and determination of transient response of RLC circuit.
11. Determination of characteristics of a solid state sensor/fibre-optic sensor
12. Design and test a signal conditioning circuit for any transducer
13. Study of data acquisition system using "**LabVIEW**" software and test all signal points
14. Measurement of sine, triangular ,square wave signal of function generator and verify its frequency at 100 Hz tap point using "labview" software.
15. Measurement of voltage and current signal of programmable power supply using Lab view GPIB interface.

Note: - Three more software based experiments may be added in place of experiments nos.13 to at the institute level.

EEN-753: PROJECT

L T P 0 0 3

Project shall be assigned to students at the start of VIIth semester. There should not usually be more than 3 students in batch. The project should be based on latest technology as far as possible and it may be hardware or/and software based. The assessment of performance of students should be made at least twice in the semester. Students should be encouraged to present their progress of project using overhead projector or LCD projector.

EEN-754: INDUSTRIAL TRAINING

L T P 0 0 2

Students will go practical & Industrial training of four weeks in any industry or reputed organization after the VIth semester examination in summer. They will also prepare an exhaustive technical report of the training which will be duly signed by the officer under whom training was taken in the industry/organization. They will have to present about the training before a committee consisting of faculty members constituted by the concerned Head of the Department.

EOE-081: NON CONVENTIONAL ENERGY RESOURCES

L T P 3 1 0

1. Preamble: The energy sector globally provides significant research challenges in the continuous development of new materials, devices and energy systems. Fundamental research contributions are required for the development of cost-effective and sustainable energy systems like Solar, Geo Thermal, Fuel Cells, Wind, Ocean Thermal, Wave and Tidal Waves and Bio Fuels etc.

2. Course Educational Objectives

Students undergoing this course are expected to:

1. The Course Educational Objectives: is to develop the skills of the students in understanding the basics of Solar energy, Geothermal Energy, Wind and fuel cell.
2. The objective of this course is to make students familiar with the Bio Energy, Thermionic and Thermo Electric Energy conversion.
3. Knowledge of OTEC, Wave and Tidal Wave etc is necessary to understand the global scope and Scope of Renewable Energy resources in INDIA.
4. The course will also serve as a prerequisite for post graduate and specialized studies and research specially in the field of Solar Energy and Wind Energy.

3. Course Outcomes:

Students undergoing this course are able to

1. Understand various types of renewable energy resources their working and their different applications.
2. Students will be able to learn the Global Scope of Renewable Resources of Energy as well as the Indian scenario of Renewable Energy and future scope of these energies.

4. Link to other courses

Major Project

5. Course Content

UNIT-I

Introduction

Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.

Solar Cells:

Theory of solar cells. solar cell materials, solar cell array,
solar cell power plant, limitations.

Solar Thermal Energy:

Solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants,

thermal energy storage for solar heating and cooling, limitations.

UNIT-II

Geothermal Energy:

Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations.

Magneto-hydrodynamics (MHD):

Principle of working of MHD Power plant, performance and limitations.

Fuel Cells:

Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-III

Thermo-electrical and thermionic Conversions:

Principle of working, performance and limitations.

Wind Energy:

Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. performance and limitations of energy conversion systems.

UNIT-IV & V

Bio-mass:

Availability of bio-mass and its conversion theory.

Ocean Thermal Energy Conversion (OTEC):

Availability, theory and working principle, performance and limitations.

Wave and Tidal Wave:

Principle of working, performance and limitations.

Text/References Books:

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, "Energy Resources: Conventional & Non-Conventional "BSP Publications, 2006.

EEE-052: ADVANCED CONTROL SYSTEM

L T P 3 1 0

1. **PREAMBLE:** This course gives concepts and techniques of linear and nonlinear control system analysis and synthesis in state space framework, stability analysis of nonlinear systems and introduction to optimal control problem

2. **COURSE EDUCATIONAL OBJECTIVES**

1. Review of state variable representation of continuous system
2. Conversion of state variable models to transfer function and vice-versa
3. Solution of state equations and state transition matrix
4. Controllability and observability
5. Design of state observer and controller
6. Discrete system and discrete time signals
7. Jury stability criterion, bilinear transformation, Routh-Hurwitz criterion on rth planes, Lyapunov's stability theorems for continuous and discrete systems
8. Introduction, formation of optimal control problem.

3. **COURSE OUTCOMES**

1. Study the conversion of state variable models to transfer function and vice-versa, solution of state equations and state transition matrix.
2. Learn the discrete system and discrete time signals, state variable model and transfer function model of discrete system,
3. Study Lyapunov's stability theorems for continuous and discrete systems, and Popov's criterion.
4. Analyze non linear systems, linearization method, second order non-linear system on the phase plane, types of phase portraits, singular points.
5. Study linear quadratic problem- Hamilton, Jacobi equation, Riccati equation and its solution
6. Acquire basic knowledge of neural network, fuzzy logic and genetic algorithms.

4. **PRE-REQUISITE:**

Engineering Mathematics and Basics of Control system Engineering.

5. **LINKS TO OTHER COURSES**

Power system operation and control.

6. Course Content:

Unit-I

State Space Analysis of Continuous System:

Review of state variable representation of continuous system, conversion of state variable models to transfer function and vice-versa, solution of state equations and state transition matrix, controllability and obsrvability, design of state observer and controller

Unit-II

Analysis of Discrete System:

Discrete system and discrete time signals, state variable model and transfer function model of discrete system, conversion of state variable model to transfer function model and vice-versa, modeling of sample-hold circuit, solution of state difference equations, steady state accuracy, stability on the z-plane and Jury stability criterion, bilinear transformation, Routh-Hurwitz criterion on rth planes

Unit-III

Stability:

Lyapunov's stability theorems for continuous and discrete systems, methods for generating Lyapunov function for continuous and discrete system, Popov's criterion.

Non linear System:

Types of non linearities, phenomena related to non - linear systems.

Analysis of non linear systems-Linearization method, second order non-linear system on the phase plane, types of phase portraits, singular points, system analysis by phase-plane method, describing function and its application to system analysis.

Unit-IV

Optimal Control:

Introduction, formation of optimal control problem, calculus of variations minimization of functions, constrained optimization. Pontryagin's Minimum Maximum Principle, Linear Quadratic Problem-Hamilton Jacobi equation, Riccati equation and its solution.

Unit-V

Adaptive Control:

Introduction, model reference adaptive control systems, controller structure, self tuning regulators. Introduction to neural network, fuzzy logic and genetic algorithms

Text Books:

1. M.Gopal, "Digital Control and State variable Methods", Tata Mc Graw Hill
2. Ajit K.Madal, "Introduction to Control Engineering: Modelling, Analysis and Design" New Age International.
3. D.Landau, "Adaptive Control", Marcel Dekker Inc.
4. S.Rajasekaran & G.A.Vjayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Alogorithms: Synthesis and Applications" Prentice Hall of India.

Reference Books:

1. Donald E. Kiv, "Optimal Control Theory: An Introduction" Prentice Hall
2. B.C. Kuo, "Digital Control Systems" Sounders College Publishing
3. C.H.Houpis and G.B.Lamont,"Digital Control Systems:Theory,Hardware, Software"Mc Graw Hill.

EEC-069: SATELLITE COMMUNICATION

L T P 3 1 0

1. **Preamble:** This course gives concepts of elements of communication and different modulation techniques that are used in satellite communication. It also gives the knowledge about the propagation effects and their impact on satellite earth link.

2. **Course Educational Objectives:** Students undergoing this course are expected to:
   1. Provide an in-depth treatment of satellite communication systems operation and planning.
   2. Provide in-depth understanding of modern satellite multiple accesses, modulation and coding schemes.
   3. Review the state of the art in new research areas such as speech and video coding, satellite networking and satellite personal communications.

3. **Course Outcomes:** Students undergoing this course are able to
   1. Recall the fundamentals of orbital mechanics, identify the characteristics of common orbits used by communications and other satellites, and assess launch methods and technologies.
   2. Identify the systems required by a communications satellite to function and the trade-offs and limitations encountered in the design of a communications satellite system.
   3. Identify the radio propagation channel for Earth station to satellite and satellite to satellite communications links, and describe the basics of designing antenna systems to accommodate the needs of a particular satellite system.
   4. Calculate an accurate link budget for a satellite or other wireless communications link.
   5. Assess the analog and digital technologies used for satellite communications networks and the topologies and applications of those networks, and compare them to alternative systems.

4. **Pre-requisites:**
   - Signals and systems.
   - Random processes.

5. **Link to other courses:** Wireless communication.

6. **Course Content**

Unit - I

Elements of Satellite Communication: Orbital mechanics, look angle and orbit determination, launches & launch vehicle, orbital effects, Geostationary Orbit.

Propagation effects and their impact on satellite-earth links: attenuation and depolarization, atmospheric absorption, rain, cloud and ice effects etc.

Unit - II

Satellite subsystems: attitude and orbit control systems, TTC&M, communication subsystem, satellite antenna, satellite link design: basic transmission theory, system noise temperature and G/T ratio, downlink design, uplink design, satellite systems using small earth station, design for specified C/N.

Unit - III

Modulation and multiplexing techniques for satellite links: FM, pre-emphasis and de-emphasis, S/Nratios for FM video transmission, digital transmission, digital modulation and demodulation, TDM.

Multiple Access: FDMA, TDMA, DAMA and CDMA.

Unit - IV

Error control for digital satellite links: error detection and correction, channel capacity, error controlcoding, convolutional codes, linear and cyclic block codes.

Unit - V

Introduction: VSAT, low earth orbit and non-geostationary, direct broadcast satellite television and radio, satellite navigation and the global positioning systems.

Text Books:

1. Satellite Communications / Pratt, Bostian, Allnutt / John Wiley & Sons, 2nd edition.
2. Digital Satellite Communications/ Tri T. Ha./ McGraw-Hill

Reference Books:

1. Satellite Communications / Dennis Roddy / McGraw-Hill 4th edition.

EEC-809: DATA COMMUNICATION NETWORKS

L T P 3 1 0

1. Preamble: Data communications refers to the transmission of digital data between two or more computers and a computer network or data network is a telecommunications network that allows computers to exchange data. The physical connection between networked computing devices is established using either cable media or wireless media. The best-known computer network is the Internet.

2. Course Educational Objectives

1. To enrich the students with fundamentals and application knowledge of Communication Networks.
2. To provide the students' knowledge about OSI Reference Layers and their relevance detailed working of protocols for real time application.

3. Course Outcomes: On successful completion of this course students will be able to:

1. To Identify, formulate and solve engineering related problems on network structure, network architectures, OSI reference model, services, and standardization.
2. To design network structures and to analyze the physical layer's transmission media, EIA RS¬232C, EIA RS¬449 with realistic constraints.
3. To use the techniques, skills, and modern engineering tools necessary for routing Algorithms, Congestion control Algorithms, Subnet concept, Virtual circuit, Routers, Gateways and different level switches.
4. To visualize and understand the necessity of Design Issues, Connection management, Internet and ATM transport layer protocols and data link layer basic link protocols which are character oriented and bit oriented protocols.
5. To recognize the need for lifelong learning of Application layer services: DNS, DHCP, FTP, TFTP, SMTP, SNMP, HTTP, WWW.

4. Pre-Requisites:

- Digital Electronics.
- Analog and Digital Communication.

5. Links to Other Courses

- Analog and Digital Communication.
- Telemetry and Data Transmission

Course Content:

UNIT I

Introduction: Network structure, network architectures. The OSI reference model, services, Standardization, Other architectures, Connection oriented and connection less services, example networks.

The Physical Layer: Transmission media, EIA RS-232C, EIA RS-449.Pulse code modulation. FDM & TDM. Circuit switching. Packet switching. Hybrid switching Polling. CCITT X.21. Ethernet.

UNIT II

The Data Link Layer: Basic link protocols. Character oriented and bit oriented protocols. The ALOHA protocols.

IEEE standard 802 for LAN, framing, Error control, Flow control

UNIT III

The Network Layer: Design Issues. Routing Algorithms. Congestion control Algorithms. Subnet concept, Virtual circuit and Data gram Subnet, Flow control, Internetworking, Bridges, Routers, Gateways and different level switches.

UNIT IV

The Transport Layer: Design Issues. Connection management. Study of Internet and ATM transport layer protocols.

Internet Issues: Principles of bridges and routers.

UNIT V

The TCP/IP Protocol suite:

Overview of TCP/IP. Addressing, Subnetting and network layer protocols. Application layer services: DNS, DHCP, FTP, TFTP, SMTP, SNMP, HTTP, WWW.

Text Books:

1. Andrew S. Tanenbaum: Computer Networks, PHI India.
2. Leon-Garcia,Widjaja: Communication Networks, TMH.
3. Forouzan: Data Communications & Networking, TMH.
4. William Stallings: Data & Computer Communication, Prentice Hall