SHRI VENKATESHWARA   UNIVERSITY

Syllabus

B.Tech

Electrical Engineering
V SEMESTER
(Four Years Programme)

(w.e.f. 2019-20)

SCHOOL OF ENGINEERIN & TECHNOLOGY

Electrical Engineering
SEMESTER V

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	**SEE- 501**	Power Systems – I (Apparatus and Modelling)	3	0	0	20	10	30		70		100	3
2	**SEE- 502**	Control Systems	3	0	0	20	10	30		70		100	3
3	**SEE-503**	Microprocessors	3	0	0	20	10	30		70		100	3
4	**SEE-504**	Power System Protection	3	0	0	20	10	30		70		100	3
5	SEE-505	Power Plant Engineering	3	0	0	20	10	30		70		100	3
6	**SOE-051**	Application of Psychology	2	0	0	20	10	30		70		100	2
7	**SEE- 511**	Power Systems Lab - I	0	0	2				25		25	50	1
8	**SEE- 512**	Control Systems Lab	0	0	2				25		25	50	1
9	**SEE- 513**	Microprocessors Lab	0	0	2				25		25	50	1
												750	**20**

SEE- 501	Power Systems – I (Apparatus and Modelling)
CREDIT	3

Course Outcomes:

At the end of this course, students will demonstrate the ability to
- Understand the concepts of power systems.
- Understand the various power system components.
- Evaluate fault currents for different types of faults.
- Understand the generation of over-voltages and insulation coordination.
- Understand basicprotection schemes.
- Understand concepts of HVdc power transmission and renewable energy generation.

Module 1: Basic Concepts (4 hours)

Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids.

Generation: Conventional and Renewable Energy Sources. Distributed Energy Resources. Energy Storage. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Review of Three-phase systems. Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power.

Module 2: Power System Components (15 hours)

Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors, Corona. Parameters of lines and cables. Capacitance and Inductance calculations for simple configurations. Travelling-wave Equations. Sinusoidal Steady state representation of Lines: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power.

Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines.

Transformers: Three-phase connections and Phase-shifts. Three-winding transformers, auto-transformers, Neutral Grounding transformers. Tap-Changing in transformers.
Transformer Parameters. Single phase equivalent of three-phase transformers.

Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. Real and Reactive Power Capability Curve of generators. Typical waveform under balanced terminal short circuit conditions – steady state, transient and sub-transient equivalent circuits. Loads: Types, Voltage and Frequency Dependence of Loads. Per-unit System and per-unit calculations.

Module 3: Over-voltages and Insulation Requirements (4 hours)

Generation of Over-voltages: Lightning and Switching Surges. Protection against Over-voltages, Insulation Coordination. Propagation of Surges. Voltages produced by traveling surges. Bewley Diagrams.

Module 4: Fault Analysis and Protection Systems (10 hours)

Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults. Representation of generators, lines and transformers in sequence networks. Computation of Fault Currents. Neutral Grounding.

Switchgear: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application.

Module 5: Introduction to DC Transmission & Renewable Energy Systems (9 hours)

DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC). LCC and VSC based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission. Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines. Permanent Magnetic Synchronous Generators and Induction Generators. Power Electronics interfaces of wind generators to the grid.

Text/References:

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.
2. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
4. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
5. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.

SEE-511 Power Systems – I Laboratory (0:0:2 – 1 credit)

Hands-on experiments related to the course contents of SEE501 . Visits to power system installations (generation stations, EHV substations etc.) are suggested. Exposure to fault analysis and Electro- magnetic transient program (EMTP) and Numerical Relays are suggested

SEE- 502	Control Systems

Course Outcomes:
At the end of this course, students will demonstrate the ability to
- Understand the modelling of linear-time-invariant systems using transfer function and state-space representations.
- Understand the concept of stability and its assessment for linear-time invariant systems.
- Design simple feedback controllers.

Module 1: Introduction to control problem (4 hours)
Industrial Control examples. Mathematical models of physical systems. Control hardware
and theirmodels. Transfer function models of linear time-invariant systems.
Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram
algebra.

Module 2: Time Response Analysis (10 hours)
Standard test signals. Time response of first and second order systems for standard test inputs.
Application of initial and final value theorem. Design specifications for second-order systems based
on the time-response.

Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique.
Construction of Root-loci.

Module 3: Frequency-response analysis (6 hours)

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Module 4: Introduction to Controller Design (10 hours)

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems.
Root-loci method of feedback controller design.
Design specifications in frequency-domain. Frequency-domain methods of design.
Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation indesigns.
Analog and Digital implementation of controllers.

Module 5: State variable Analysis (6 hours)

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability.
Pole-placement by state feedback.
Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems.Stability of linear discrete-time systems.

Module 6: Introduction to Optimal Control and NonlinearControl(5 hours)

Performance Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts andanalysis.

Text/References:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.
3. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
4. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009

SEE 512: Control Systems Laboratory (0:0:2 – 1 credit)

Hands-on/Computer experiments related to the course contents of EE16.

SEE-503	Microprocessors

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Do assembly language programming.
- Do interfacing design of peripherals like I/O, A/D, D/A, timer etc.
- Develop systems using different microcontrollers.

Module 1: Fundamentals of Microprocessors: (7 Hours)

Fundamentals of Microprocessor Architecture. 8-bitMicroprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

Module 2: The 8051 Architecture (8 Hours)

Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

Module 3: Instruction Set and Programming (8 Hours)

Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.

Module 4: Memory and I/O Interfacing (6 Hours):

Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, memory devices.

Module 5: External Communication Interface (6 Hours)

Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee.

Module 6: Applications (6 Hours)

LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing.

TEXT// References:
1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, "The8051Microcontroller and Embedded Systems: Using Assembly and C",Pearson Education, 2007.
2. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning,2004.
3. R. Kamal, "Embedded System", McGraw Hill Education,2009.
4. R. S. Gaonkar, ", Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996
5. D.A. Patterson and J.H. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Morgan Kaufman Publishers, 2013.
6. D. V. Hall, "Microprocessors & Interfacing", McGraw Hill Higher Education, 1991.

SEE -513 : Microprocessor Laboratory (0:0:2 – 1 credit)
  Hands-on experiments related to the course contents of SEE-503.

SEE504	Power System Protection	3L:0T:0P	3 credits

Course Outcomes: At the end of this course, students will demonstrate the ability to
- Understand the different components of a protection system.
- Evaluate fault current due to different types of fault in a network.
- Understand the protection schemes for different power system components.
- Understand the basic principles of digital protection.
- Understand system protection schemes, and the use of wide-area measurements.

Module 1: Introduction and Components of a Protection System (4 hours)
  Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers

Module 2: Faults and Over-Current Protection (8 hours)
  Review of Fault Analysis, Sequence Networks. Introduction to Overcurrent Protection and overcurrent relay co-ordination.

Module 3: Equipment Protection Schemes(8 hours)
  Directional, Distance, Differential protection. Transformer and Generator protection. Bus bar Protection, Bus Bar arrangement schemes.

Module 4: Digital Protection (8 hours)
  Computer-aided protection, Fourier analysis and estimation of Phasors from DFT. Sampling, aliasing issues.

Module 5: Modeling and Simulation of Protection Schemes (8 hours)
  CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing.

Module 6: System Protection (4 hours)
  Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of-step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.

Text/References
1. J. L. Blackburn, "Protective Relaying: Principles and Applications", Marcel Dekker, New York, 1987.
2. Y. G.Paithankar and S. R. Bhide, "Fundamentals of power system protection", Prentice Hall, India, 2010.
3. A. G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", John Wiley & Sons, 1988.
4. A. G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer, 2008.
5. D. Reimert, "Protective Relaying for Power Generation Systems", Taylor and Francis, 2006.

SEE-505	Power Plant Engineering	3L:0T:0P	3 credits

Objectives:
To provide an overview of power plants and the associated energy conversion issues

Contents:
Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam andheating rates,

subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems

Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Course Outcomes:
Upon completion of the course, the students can understand the principles of operation for different power plants and their economics.

Text Books:
1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

APPLICATIONS OF PSYCHOLOGY
Course code: SOE-051

Credits: 2-0-0

1. OBJECTIVES:

The objectives of this course are to make students:
1) aware of the different applications of psychology to everyday issues of life,
2) aware of the different social issues, workplace issues, and behavioural issues, and
3) understand how the knowledge gained from this course can be used in their own personal andprofessional work life.

2. COURSE TOPICS:

Unit 1: Introduction: Nature and fields.   (6)

Unit 2: Psychology in industries and organizations: Job analysis; fatigue and

accidents;

consumer behavior. (8)

Unit 3: Psychology and mental health: Abnormality, symptoms and causes psychological

disorders.(10)

Unit 4: Psychology and Counseling: Need of Counseling, Counselor and the Counselee,

Counseling Process, Areas of Counseling. (6)

Unit 5: Psychology and social behavior: Group, group dynamics, teambuilding, Prejudice and

stereotypes; Effective Communication, conflict and negotiation. (10)

Text

1. Schultz, D. & Schultz, S.E. (2009). Psychology and Work Today (10th ed.). NewJersey:Pearson/Prentice Hall.
2. Butcher, J. N., Mineka, S., & Hooley, J. M. (2010). Abnormal psychology (14th ed.). NewYork: Pearson
3. Gladding, S. T. (2014). Counselling: A comprehensive profession. New Delhi: PearsonEducation
4. Aronson, E., Wilson, T. D., & Akert, R. M. (2010). Social Psychology (7th Ed.). UpperSaddle River, NJ: Prentice Hall.