Syllabus of

UNDERGRADUATE DEGREE COURSE

B.Tech. V Semester

Electrical And Electronics Engineering

Rajasthan Technical University, Kota

Effective from session: 2019 – 2020

5EX3-01: NEURAL NETWORK

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**

2L+0T+0P **End Term Exam: 2 Hours**

SN	CONTENTS	HOURS
1.	**Introduction:** Objective, scope and outcome of the course.	01
2.	**Introduction to Neural Networks**: Biological basis for NN, Human brain, Models of a Neuron, Directed Graphs, Feedback, Network architectures, Knowledge representation, Artificial intelligence & Neural Networks.	06
3.	**Learning Processes:** Introduction, Error-Correction learning, Memory -based learning, Hebbian learning, Competitive learning, Boltzmann learning, Learning with a Teacher & without a teacher, learning tasks, Memory, Adaptation.	05
4	**Single Layer Perceptrons:** Introduction, Least-mean-square algorithm, Learning Curves, Learning rate Annealing Techniques, Perceptron, Perceptron Convergence Theorem.	06
5	**Multilayer Perceptrons:** Introduction, Back-Propagation Algorithm, XOR Problem, Output representation and Decision rule, Feature Detection, Back-Propagation and Differentiation, Hessian Matrix, Generalization.	06
6.	**Radial-basis function Networks & Self-organizing Maps:** Introduction to Radial basis function networks, Cover's Theorem on the Separability of Patterns, Interpolation Problem, Generalized Radial-Basis function networks, XOR Problem, Self-Organizing map, Summary of SOM Algorithm, Properties of the feature map.	03
	TOTAL	27

5EX4-02: POWER SYSTEM - I

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Basic Concepts** 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.	04
3	**Power System Components:** 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, autotransformers, 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.	15
4	**Over-voltages and Insulation Requirements** Generation of Over-voltages: Lightning and Switching Surges. Protection against Overvoltages, Insulation Coordination. Propagation of Surges. Voltages produced by traveling surges. Bewley Diagrams.	04

5	**Fault Analysis and Protection Systems** 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.	**09**
6	**Introduction to DC Transmission & Renewable Energy Systems** 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	**09**
	TOTAL	**42**

5EX4-03: CONTROL SYSTEM

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Introduction to control problem** Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra	04
3	**Time Response Analysis:** 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..	09
4	**Frequency-response analysis** 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.	06
5	**Introduction to Controller Design** 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 in designs. Analog and Digital implementation of controllers	10
6	**State variable Analysis** 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	06
7	**Introduction to Optimal Control and Nonlinear Control** Performance Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts and analysis	05
	TOTAL	41

5EX4-04: MICROPROCESSOR

Credit: 3 **Max. Marks: 150(IA:30, ETE:150)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Fundamentals of Microprocessors** 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.	07
3	**The 8051 Architecture:** 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.	08
4	**Instruction Set and Programming** 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..	08
5	**Memory and I/O Interfacing** 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.	06
6	**External Communication Interface** Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee.	06
7	**Applications** LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing	05
	TOTAL	41

5EX4-05: ANALOG COMMUNICATION

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Noise Effects in Communication Systems:** Resistor noise, Networks with reactive elements, Noise temperature, Noise bandwidth Effective input noise temperature, Noise figure. Noise figure & equivalent noise temperature in cascaded circuits.	08
3	**Amplitude Modulation:** Frequency translation, Recovery of base band signal, Spectrum & power relations in AM systems. Methods of generation & demodulation of AM-DSB, AM-DSB/SC and AM-SSB signals. Modulation & detector circuits for AM systems. AM transmitters & receivers.	08
4	**Frequency Modulation:** Phase & freq. modulation & their relationship, Spectrum & band width of a sinusoidally modulated FM signal, phasor diagram, Narrow band & wide band FM. Generation & demodulation of FM signals. FM transmitters &receivers. Comparison of AM, FM & PM. Pre emphasis & demphasis. Threshold in FM, PLL demodulator.	08
5	**Noise in AM and FM:** Calculation of signal-to-noise ratio in SSB-SC, DSBSC, DSB with carrier, Noise calculation of square law demodulator & envelope detector. Calculation of S/N ratio in FM demodulators, Super heterodyne receivers.	08
6	**Pulse Analog Modulation:**Practical aspects of sampling, Natural and flat top sampling. PAM, PWM, PPM modulation and demodulation methods, PAM-TDM.	08
	TOTAL	41

5EX5-11: BIOMEDICAL INSTRUMENTATION

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**

2L+0T+0P **End Term Exam: 2 Hours**

SN	CONTENTS	HOURS
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Human Body Subsystems:** Brief description of neural, muscular, cardiovascular and respiratory systems; their electrical, mechanical and chemical activities. **Transducers and Electrodes:** Principles and classification of transducers for Biomedical applications, Electrode theory, different types of electrodes, Selection criteria for transducers and electrodes.	06
3	**Biopotential:** Electrical activity of excitable cells, ENG, EMG, ECG, ERG, EEG. Neurone potential. Cardio Vascular System Measurements: Measurement of blood pressure, blood flow, cardiac output, cardiac rate, Heart sounds, Electrocardiograph, phono-cardiograph, Plethysmograph, Echocardiograph.	05
4	**Instrumentation for Clinical Laboratory**: Measurement of pH valve of blood, ESR measurement, haemoglobin measurement, O2and CO2concentration in blood, GSR measurement. Instrumentation for clinical laboratory: Spectrophotometry, chromatography, Haematology, Measurement of pH value, concentration in blood. Medical Imaging: DiagnosticX-rays, CAT, MRI, thermography, Ultrasonography, medical use of isotopes, endoscopy.	06
5	**Patient Care, Monitoring and Safety Measures:** Elements of Intensive care monitoring basic hospital systems and components, physiological effect of electric current shock hazards from electrical equipment, safety measures, Standards & practices. **Computer Applications and Biotelemetry:** Real time computer applications, data acquisi. tion and processing, remote data recording and management.	06
6	**Therapeutic and Prosthetic Devices:** Introduction to cardiac pacemakers, defibrillators, ventilators, muscle stimulators, diathermy, heart lung machine, Hemodialysis, Applications of Laser.	03
	TOTAL	27

5EX5-12: PRINCIPLE OF COMMUNICATION SYSTEM

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**

2L+0T+0P **End Term Exam: 2 Hours**

SN	CONTENTS	HOURS
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Noise Effects in Communication Systems:** Resistor noise, Networks with reactive elements, Noise temperature, Noise bandwidth, effective input noise temperature, Noise figure. Noise figure & equivalent noise temperature in cascaded circuits.	06
3	**Amplitude Modulation:** Frequency translation, Recovery of base band signal, Spectrum & power relations in AM systems. Methods of generation & demodulation of AM-DSB, AMDSB/SC and AM-SSB signals. Modulation & detector circuits for AM systems. AM transmitters & receivers.	05
4	**Frequency Modulation:** Phase & freq. modulation & their relationship, Spectrum & bandwidth of a sinusoidally modulated FM signal, phasor diagram, Narrow band & wide band FM. Generation & demodulation of FM signals. FM transmitters & receivers, Comparison of AM, FM & PM. Pre emphasis & de- emphasis. Threshold in FM, PLL demodulator.	06
5	**Noise in AM and FM:** Calculation of signal-to-noise ratio in SSB-SC, DSB- SC, DSB with carrier, Noise calculation of square law demodulator & envelope detector. Calculation of S/N ratio in FM demodulators, Super-heterodyne receivers.	06
6	**Pulse Modulation Systems:** Sampling theorem, Generation and demodulation methods of PAM, PWM, PPM.	03
	TOTAL	27

5EX5-13: INTRODUCTION TO VLSI

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**
2L+0T+0P **End Term Exam: 2 Hours**

SN	CONTENTS	HOURS
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Introduction to MOS Technology:** Basic MOS transistors, Enhancement Mode transistoraction, Depletion Mode transistor action, NMOS and CMOS fabrication.	06
3	**Basic Electrical Properties of MOS Circuits:** IDS versus VDS relationship, Aspects of threshold voltage, Transistor Trans conductance gm. The NMOS inverter, Pull up to Pull-down ratio for a NMOS Inverter and CMOS Inverter (Bn/Bp), MOS transistor circuit Model, Noise Margin.	05
4	**CMOS Logic Circuits:** The inverter, Combinational Logic, NAND Gate NOR gate, Compound Gates, 2 input CMOS Multiplexer, Memory latches and registers Transmission Gate, Gate delays, CMOS-Gate Transistor sizing, Power dissipation	06
5	**Basic Physical Design of Simple Gates and Layout Issues:** Layout issues for inverter, Layout for NAND and NOR Gates, Complex Logic gates Layout, Layout optimization for performance.	06
6.	**Introduction to VHDL:** Verilog & other design tools. VHDL Code for simple Logic gates, flip-flops, shift-registers, Counters, Multiplexers, adders and subtractors.	03
	TOTAL	27

5EX4-21: POWER SYSTEM -I LAB

Credit: 1 **Max. Marks: 50(IA:30, ETE:20)**
0L+0T+2P **End Term Exam: 2 Hours**

1) Generating station design: Design considerations, basic schemes and single line diagram of hydro, thermal, nuclear and gas power plants. Electrical equipment for power stations.
2) Distribution system Design: Design of feeders & distributors. Calculation of voltage drops in distributors. Calculation of conductor size using Kelvin's law.
3) Study of short term, medium term and long term load forecasting.
4) Sending end and receiving end power circle diagrams.
5) Substations: Types of substations, various bus–bar arrangements. Electrical equipment for substations.
6) Study high voltage testing of electrical equipment: line insulator, cable, bushing, power capacitor, and power transformer.
7) Design an EHV transmission line
8) Study filtration and Treatment of transformer oil.
9) Determine dielectric strength of transformer oil.
10) Determine capacitance and dielectric loss of an insulating material using Schering bridge.
11) Flash over voltage testing of insulators.

5EX4-22: CONTROL SYSTEM LAB

Credit: 1 **Max. Marks: 50(IA:30, ETE:20)**

0L+0T+2P **End Term Exam: 2 Hours**

1. (a) Plot step response of a given TF and system in state-space. Take different values of damping ratio and w_n natural undamped frequency.

   (b) Plot ramp response.

2. To design 1st order R-C circuits and observe its response with the following inputs and trace the curve.
   (a) Step
   (b) Ramp (c) Impulse

3. To design 2nd order electrical network and study its transient response for step input and following cases.
   (a) Under damped system
   (b) Over damped System.
   (c) Critically damped system.

4. To Study the frequency response of following compensating Networks, plot the graph and final out corner frequencies.
   (a) Leg Network
   (b) Lead Network. (c) Leg-lead Network.

5. Draw the bode plot in real time for a Non-Inverting amplifier.

6. Draw the bode plot in real time for an Inverting amplifier.

7. Draw the bode plot for second order transfer function.

8. Draw the bode plot for first order transfer function.

9. Design and analyse Tow- Thomas biquad filter.

10. Design and calculate Kp, Ki for PI controller.

11. Design PID controller and also calculate Kp, Ki, Kd for it.

5EX4-23: MICROPROCESSOR LAB

Credit: 1 **Max. Marks: 50(IA:30, ETE:20)**
0L+0T+2P **End Term Exam: 2 Hours**

1. Study the hardware, functions, memory structure and operation of 8085-Microprocessor kit.
2. Program to perform integer division: (1) 8-bit by 8-bit (2) 16-bit by 8-bit.
3. Transfer of a block of data in memory to another place in memory
4. Transfer of black to another location in reverse order.
5. Searching a number in an array.
6. Sorting of array in: (1) Ascending order (2) Descending order.
7. Finding party of a 32-bit number.
8. Program to perform following conversion (1) BCD to ASCII (2) BCD to hexadecimal.
9. Program to multiply two 8–bit numbers
10. Program to generate and sum 15 Fibonacci numbers.
11. Program for rolling display of message “India”, “HELLO”.
12. To insert a number at correct place in a sorted array.
13. Reversing bits of an 8-bit number.
14. Fabrication of 8-bit LED interfaces for 8085 kit through 8155 and 8255.
15. Data transfer on output port 8155 & 8255 & implementation of disco light, running light, and sequential lights on the above mentioned hardware.
16. Parallel data transfer between two DYNA-85 kit using 8253 ports.
17. Generation of different waveform on 8253/8254 programmable timer.

5EX4-24: COMMUNICATION LAB

Credit: 1 **Max. Marks: 50(IA:30, ETE:20)**
0L+0T+2P **End Term Exam: 2 Hours**

1. Harmonic analysis of a square wave of modulated waveform.
2. Observe the amplitude modulated waveform and measures modulation index. Demodulation of the AM signal.
3. To modulate a high frequency carrier with sinusoidal signal to obtain FM signal. Demodulation of the FM signal.
4. To observe the following in a transmission line demonstrator kit :

   i. The propagation of pulse in non-reflecting Transmission line.

   ii. The effect of losses in Transmission line.

   iii. The resonance characteristics of al half wavelength long x-mission line.
5. To study and observe the operation of a super heterodyne receiver
6. To modulate a pulse carrier with sinusoidal signal to obtain PWM signal and demodulate it.
7. To modulate a pulse carrier with sinusoidal signal to obtain PPM signal and demodulate it.
8. To observe pulse amplitude modulated waveform and its demodulation.
9. To observe the operation of a PCM encoder and decoder .To considers reason for using digital signal x- missions of analog signals.
10. Produce ASK signals, with and without carrier suppression, Examine the different processes required for demodulation in the two cases.
11. To observe the FSK wave forms and demodulate the FSK signals based on the properties of (a) Tuned circuits (b) On PI.L.