SPPU B.E./B.Tech EE Sem 4 syllabus

Numerical Methods & Computer Programming

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Unit 01 : Numerical Computations, Errors and Concept of root of equation (6hrs)
A) Basic principle of numerical computation. Floating point algebra with normalized floating point
technique, Significant digits. Errors: Different types of errors, causes of occurrence and remedies to
minimize them, Generalized error formula (Derivation and Numerical)
B) Concept of roots of an equation. Descartes' rule of signs, Intermediate value theorem, Roots of
Polynomial Equations using Birge-Vieta method.
Unit 02: Solution of Transcendental and polynomial equation and Curve Fitting: (6hrs)
A) Solution of Transcendental and polynomial equation using Bisection, Regula- Falsi, Newton-Raphson
method for single variable and two variables.
B) Curve fitting using least square approximation – First order and second order
Unit 03: Interpolation (6hrs)
Forward, Backward, Central and Divided Difference operators, Introduction to interpolation.
A)Interpolation with equal Intervals - Newton's forward, backward interpolation formula (Derivations
and numerical), Stirling's and Bessel's central difference formula (Only numericals)
B) Interpolation with unequal Intervals- Newton's divided difference formula and Lagrange's
interpolation (Derivations and numerical).
Unit 04: Numerical Differentiation and Integration (6hrs)
A) Numerical Differentiation using Newton's forward and backward

interpolation formula (Derivation
and numerical).
B) Numerical Integration: Trapezoidal and Simpson's rules as special cases of Newton-Cote's
quadrature technique for single integral. Numerical on double integrals using Trapezoidal and Simpson's
1/3 rd rule.

Unit 05:Solution of linear simultaneous equation (6hrs)

A) Solution of linear simultaneous equation: Direct methods - Gauss elimination method, concept of
pivoting – partial and complete. Gauss Jordan method, Iterative methods – Jacobi method and Gauss
Seidel method.
B)Matrix Inversion using Gauss Jordan method

Unit 06: Solution of Ordinary Differential Equation(ODE) (6hrs)

A) Solution of First order Ordinary Differential Equation (ODE) using Taylor's series method, Euler's
method, Modified Euler's method (Derivation and numerical). Runge-Kutta fourth order method
(Numerical).
B)Solution of Second order ODE using 4th order Runge-Kutta method (Numerical)

Electrical Machines - I

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Unit 01: Transformers: (6 Hrs)

Single phase Transformer: Concept of ideal transformer. Corrugated core transformer. Toroidal
core Transformer, Useful and leakage flux, its effects. Resistance, leakage reactance and leakage
impedance of transformer windings & their effects on voltage regulation and efficiency. Exact
and approximate equivalent circuits referred to L.V. and H. V. side of the transformer. Phasor
diagrams for no-load and on load conditions. Transformer ratings. Losses in a transformer, their
variation with load, voltage & Frequency on no load losses Efficiency and condition for
maximum efficiency. All day Efficiency. Auto transformers, their ratings and applications.
Comparison with two winding transformers with respect to saving of

copper and size.

Unit 02: (6 Hrs)

Transformers:

Polarity test. Parallel operation of single-phase transformers, conditions to be satisfied,
loadsharing under various conditions. & Welding Transformer
Three Phase Transformers:
Standard connections of three phase transformers and their suitability for various applications,
voltage Phasor diagrams and vector groups. Descriptive treatment of Parallel operation of three
phase transformers Scott connection and V connections. Three winding (tertiary windings)
transformers

Unit 03: D.C. Machines (Part-1): (6 Hrs)

Construction, main parts, magnetic circuits, poles, yoke, field winding, armature core, Armature
windings: Simple lap and wave winding, commutator and brush assembly. Generating action,
E.M.F equation, magnetization curve, Flashing of Generator. Motoring action. Types of DC
motors, significance of back E.M.F, torque equation, working at no-load and on-load. Losses,
power flow diagram and efficiency. Descriptive treatment of armature reaction.

Unit 04: D.C. Machines (Part-2): (6 Hrs)

Characteristics and applications of D.C. Shunt and Series Motors, Starting of DC motors, study of
starters for series and shunt motor, solid state starters, speed control of various types of DC
motors.
Commutation: Process of commutation, time of commutation, reactance voltage, different form

Unit 05: Three Phase Induction Motor: (6 Hrs)

Construction: Stator, Squirrel cage & wound rotors. Production of rotating mmf. Principle of
working, simplified theory with constant air gap flux; slip, frequency of rotor emf and rotor
currents, mmf produced by rotor currents, its speed w.r.t. rotor and stator mmf. Production of
torque, torque-slip relation, condition for maximum torque, torque-slip Characteristics, effect of
rotor resistance on torque-slip characteristics. Relation between

starting torque, full load torque
and maximum torque. Losses in three phase induction motor, power-flow diagram, Relation
between rotor input power, rotor copper loss & gross mechanical power developed, efficiency.

Unit 06: Three Phase Induction Motor: (6 Hrs)

Induction motor as a generalized transformer; phasor diagram. Exact & approximate equivalent
circuit. No load and blocked rotor tests to determine the equivalent circuit parameters and plotting
the circle diagram. Computation of performance characteristics from the equivalent circuit and
circle diagram. Performance curves. Necessity of starter for 3-phase induction motors. Starters for
slip-ring and cage rotor induction motors, comparison of various starters. Testing of three phase
induction motor as per IS 325 & IS 4029.

Network Analysis

Unit 1 Types of Network, Mesh and Nodal analysis

Lumped and Distributed, Linear and Nonlinear, Bilateral and Unilateral, Time-variant and Time-
invariant. Independent and Dependent (controlled) voltage and current sources. Concept of

voltage and current divider, Source transformation and shifting. Network Equations: Network
equations on Loop basis and Node basis, choice between Loop analysis and Nodal analysis.
Concept of super node and super mesh, mutual inductance, Dot convention for coupled circuits,
Concept of duality and dual networks.

Unit 2: Network Theorem

Superposition, Thevenin, Norton, Maximum Power Transfer Theorem, Reciprocity, Millman
theorems applied to electrical networks with all types of sources.
Graph Theory : Tree ,Co-tree, Incidence matrix ,F-cutest Matrix, Tie set B Matrix

Unit 3: Transients in RLC circuit

Solutions of differential equations and network equations using classical method for R-L, R-C

and R-L-C circuits, Initial and Final Condition (series and parallel).

Unit 4: Laplace Transform

Basic Properties of Laplace Transform, Laplace Transform of Basic R, L and C components,
Solutions of differential equations and network equations using Laplace transform method for
RL, R-C and R-L-C circuits (series and parallel), Inverse Laplace transforms, transformed
networks with initial conditions. Analysis of electrical circuits with applications of step, pulse,
impulse & ramp functions, shifted & singular functions the convolution integral,application of
initial and final value theorem.

Unit 5 Two port network and Filters

Two Port Network: Z, Y, H and transmission parameters,
Interrelations between parameters.
Introduction to passive filters, low pass filters, high pass filters and m-derived LPF and HPF
filters and design.

Unit 6 Network Functions:

Poles and Zeros: Terminal pairs or ports, network functions for the one port and two ports, the
calculation of network functions, general networks. Poles and zeros of network functions,
Restrictions on poles and zeros locations for transfer functions and driving point function, Time –domain behavior from the pole and zero plot. Stability of active networks. Parallel Resonance,
Resonance frequency, Quality factor, Current and resonance.

Fundamentals of Micro-Controllers and Applications

Unit 01 :

Introduction to concept of microcontroller, Intel 8051 Functional block diagram, Functions of
pins of 8051, Memory organization of 8051, PSW and Flag Bits, Stack and Stack pointer.
Overview of special function registers,Data transfer instructions and programs in assembly
language.

Unit 02 :

Arithmetic and logical instructions and programs in assembly language.Boolean and Program
Branching instructions and programs in assembly

language.Addressing modes of 8051.

Unit 03 :

8051 Programming in C , Data types in C . Ports of 8051, their use, and programming in C (Byte
Level and Bit-level). Time delay programming in C.

Timers and counters in 8051, Timer modes 0,1,2 and its programming in C and counter-
programming.

Unit 04 :

Interrupt structure of 8051 and SFR associated with interruptsProgramming of External hardware
interrupts in C.Interfacing of ADC 0809 with 8051.

Unit 05 :

Serial port Structure in 8051. Programming of Serial port for transferring and
receiving data in C in mode 1.
Introduction to GSM module, AT commands, Programming to send and read SMS.

Unit 06 :

Measurement of electrical parameters such as voltage, current (Theoretical Treatment only).
Interfacing of Stepper motor with 8051 and its programming in C.Interfacing and programming
of single Key, LED, and Relay with 8051 in C.

Power System I

Power System-I

Unit 01: Structure of Electrical Power Systems and Tariff [6Hrs]

A) Structure of Electrical Power Systems: Structure of electrical power system, Different factors associated with generating stations such as Connected load, Maximum demand, Demand factor, Average load, Load factor, diversity factor, Plant capacity factor, Reserve capacity, Plant use factor, Load curve, Load duration curve, Concept of baseload and peak load stations, Advantages of interconnected grid system, Fitting of available generating station into the area load duration curve. [4 Hrs]
B) Tariff: Introduction of Tariff, Tariff setting principles, desirable

characteristics of tariff, various consumer categories and implemented tariff such as two part tariff, three part tariff(Numerical on two part and three part tariff), Time of day tariff for H.T and L.T industrial and commercial consumers, Introduction to Availability based tariff (ABT), kVAh tariff(Descriptive treatment only).[2 Hrs]

Unit 02 Major Electrical Equipment's in Power Station & Underground Cables [6Hrs]

A) Major Electrical Equipment's in Power Station: Descriptive treatment of ratings of various equipment used in power station, Special features, field of use of equipment like alternators, necessity of exciters, various excitation systems such as dc excitation, ac excitation and static excitation systems, Power transformers, voltage regulators, bus-bars, current limiting reactors, circuit breakers, protective relays. Current transformers, potential transformers, Lightning arresters, Earthing switches, isolators, Carrier current equipment's (P.L.C.C), Control panels, battery rooms, metering and other control room equipment in generating station. [3Hrs]

B)Underground Cables: Construction of Cables, Classification of cables, XLPE cables, Capacitance of single core and three core cable, Dielectric stresses in single core cable, Grading of cables, inter sheath grading, capacitance grading. [3Hrs]

Unit 03: Mechanical Design of Overhead lines and Insulators: [6Hrs]

A) Mechanical Design of Overhead lines: Main components of overhead lines, Various types of line supports, Conductor spacing, Length of span, Calculation of sag for equal and unequal supports and effect of ice and wind loading. [3Hrs]

B) Overhead Line Insulators: Types of insulators, its construction and their applications such as Pin type, Suspension type, Strain type, Shackle type, Post insulators, bushing. Potential distribution over suspension insulators, String efficiency, (Numerical on string efficiency and up to four discs only), Methods of improving string efficiency (Descriptive treatment only). [3Hrs]

Unit 04:Resistance and Inductance of Transmission Line: [6Hrs]

Resistance of transmission line, Skin effect and proximity effect, Factors responsible for production of these effects, Internal and external flux linkages of single conductor, Inductance of single phase two wire line, Necessity of transposition, Inductance of three phase

line with symmetrical and unsymmetrical spacing with transposition, Concept of G.M.R and G.M.D, Inductance of bundled conductors

Unit 05: Capacitance of Transmission Line: [6Hrs]
Electric potential at single charged conductor, Potential at conductor in a group of charged conductors, Capacitance of single phase line, Capacitance of single phase line with effect of earth's surface on electric field, Concept of G.M.R and G.M.D for capacitance calculations, need of transposition for capacitance calculations, Capacitance of three phase line with symmetrical and unsymmetrical spacing with transposition. Capacitance of single circuit and double circuit three phase line with symmetrical and unsymmetrical spacing considering transposition (without considering earth effect).

Unit 06: Performance of Transmission Line [6Hrs]
Classification of lines based on length and voltage levels such as short, medium and long lines, Performance of short transmission lines with voltage current relationship and phasor diagram, Representation of medium lines as 'Nominal Π' and 'Nominal T' circuits using R,L and C parameters, Ferranti effect, Representation of 'T' and 'Π' models of lines as two port networks, Evaluation and estimation of generalized circuit constants (ABCD) for short and medium lines, Estimation of efficiency and regulation of short and medium lines.