### BACHELOR OF ENGINEERING (ELECTRICAL & ELECTRONICS)
#### IV SEMESTER

<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Subject</th>
<th>SCHEDULE OF TEACHING</th>
<th>SCHEME OF EXAMINATION</th>
<th>THEORY</th>
<th>PRACTICAL</th>
<th>Credits</th>
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**Note:**
*marks refer to mid semester evaluation and end semester evaluation.
AS 401
Numerical Analysis

External: 50          L T P
Sessional: 50          3 1 0
Credits : 4

Note for the paper setter: Total of 8 questions may be set covering the whole syllabus. Candidate will be required to attempt any 5 questions selecting at least two from each part.

PART A

Error analysis: Relative error, Absolute error, Round-off error, Truncation error, significant digits and numerical instability. (Scope as in Section 1.3, Chapter 1 of Reference 1).

(4 Lectures)

Transcendental and polynomial equations: Bisection method, Iteration Method based on first degree equation: Secant method, Regula-falsi method and Newton – Raphson methods, Rate of convergence of Secant method, Regula-Falsi method and Newton-Raphson Method. Bairestow’s method to find quadratic factor of a polynomial (Scope as in corresponding topics in Section 2.3, 2.5, 2.9 of Chapter 2 of Reference 1)        (8 Lectures)

Interpolation: Polynomial interpolation: Finite differences, Lagrange and Newton interpolation (Forward, Backward and Divided difference methods), inverse interpolation, Hermite interpolation (Scope as in corresponding topics in Section 4.1-4.3, 4.5 of Chapter 4 of Reference 1)

(10 Lectures)

PART B

Solution of Linear Systems: Gauss elimination method, Gauss-Seidel method, Cholesky’s Decomposition. Matrix inversion: Gauss-Jordan method. Eigenvalue problem: Bounds on Eigenvalues (Gerschgorin and Brauer theorems), Householder’s method for symmetric matrices, Power method (Scope as in corresponding topics in Section 3.2, 3.4, 3.6, 3.9, 3.11 of Chapter 3 of Reference 1).

(10 Lectures)

Numerical Integration: Trapezoidal Rule, Simpson’s 1/3 and 1/8 rule, Romberg integration, Newton – Coates formulae (Scope as in corresponding topics in Section 5.7, 5.8 of Chapter 5 of Reference 1).

(5 Lectures)

Numerical solutions of ordinary differential equations: Taylor’s series, Euler and Runge – Kutta methods. Finite difference methods for boundary value problems (Scope as in corresponding topics in Section 6.4 of Chapter 6 of Reference 1).

(5 Lectures)

Functional approximation: Chebyshev polynomials, Economization of power series, Least square approximation (Scope as in corresponding topics in Section 4.9 of Chapter 4 of Reference 1).

(3 Lectures)

References:

4. James B. Scarborough. Numerical Mathematical Analysis
EE- 401
ELECTRIC MACHINERY-II

External: 50                              L T P
Sessional: 50                                          3 1 0
Credits : 4

Note: Examiner shall set eight questions, four from Part-A and four from Part-B of the syllabus. Candidate will be required to attempt any five questions selecting at least two questions from Part A and two from Part B.

Part-A

Synchronous Machines: (18)


Part-B

Parallel operation of alternators: (12)

Synchronizing to infinite Bus-Bars, synchronoscope, parallel operation of alternators, Operating characteristics, generating Machine, motoring machine, power angle characteristic, operation at constant load with variable excitation, generating Machine, motoring machines, minimum excitation, observation, compounding curve, synchronous condenser, consideration of armature resistance, power flow (transfer) equations.

Special motors: (10)

Brushless dc motors, schematic and operation, circuit model characteristics of brushless dc motor, PM Brushless dc machine, universal motor and stepper motor, linear induction motor, Hysteresis motor, reluctance motors

Text Books:


Other Recommended Books:

1. Electrical Machinery and Transformers by Bhag S. Guru and Huseyin R. Hiziroglu,
EE- 451

ELECTRIC MACHINERY-II LAB

Sessional: 50          L T P
Credits : 2                  0 0 3

Note: At least eight experiments are to be performed.

1. To perform no load test on a 3 phase alternator (cylindrical rotor).
2. To perform short circuit test on a 3 phase alternator (cylindrical rotor). Measure the resistance of stator winding of alternator. Find out regulation of alternator at full load at (i) unity power factor (ii) 0.85 Power factor lagging (iii) 0.85 Power factor leading using synchronous impedance method.
3. To synchronize an alternator with the 3 phase supply.
4. To perform the parallel operation of two alternators.
5. To perform the slip test to determine the Xd and Xq.
6. To run a stepper motor in different modes with the help of microprocessor.
7. To analyze the power factor improvement of an industry and design the capacitor bank.
8. Computer aided transformer design
9. Computer aided induction machine design
10. Computer aided synchronous machine design
11. To obtain positive, negative and zero sequence impedances of a three phase synchronous generator
12. To obtain positive, negative and zero sequence impedances of a three phase transformer
EE- 402
CONTROL ENGINEERING

External: 50          L T P
Sessional: 50          3 1 0
Credits : 4

Note: Examiner shall set eight questions, four from Part-A and four from Part-B of the syllabus. Candidate will be required to attempt any five questions selecting at least two questions from Part A and two from Part B.

Part-A

Introductory Concepts: Open loop and closed loop control systems, Servomechanisms, feedback and effects of feedback, linear and non-linear systems, time variant & invariant, continuous and sampled data control systems, illustrative examples.

Modelling: Mathematical models of linear electrical, mechanical, translational, rotational, gear, thermal, pneumatic and hydraulic systems, electrical and mechanical analogies. Laplace transforms Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

State Space Analysis: Concepts of state variable, state vector and state space, State space representation, solution of state equation for LTI and LTV systems, state transition matrix.

Time Domain Analysis: Typical test-input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and error co-efficient.


Part-B

Root Locus Technique: The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain & sketch of the root locus plot.. Rules for construction of root locus, root contours, root sensitivity, generalized root locus.


Control Components: Error detectors- potentiometers and synchros, a.c. and d.c. servo motors, brushless d.c. motors, A.C. and D.C. techogenerators, stepper motors.

RECOMMENDED BOOKS:

Note: At least eight experiments are to be performed.

1. To study the input-output characteristics of a potentiometer and to use a potentiometer as an error detector.
2. To study transmitter - receiver characteristics of a synchros set and to use the set as control component.
3. To study the operation of d.c. position control system.
4. To study the operation of d.c. speed control system.
5. To design different compensating networks for the given cut off frequency response.
6. To study PID controller and to obtain the effect of proportional, Integral and derivative control action.
7. To study the MATLAB Programming for controls systems related to steady state and transfer function conversions.
8. To obtain the step and ramp input response for the various transfer functions using MATLAB.
9. To obtain the root locus response for different systems using MATLAB.
10. To obtain response of basic control system problems in SIMULINK and tune them in MATLAB.
11. To run and use SIMULINK based models in MATLAB.
   - To analyze and simulate the models of following real time applications in MATLAB:
12. Missile System.
13. Sun-seeker System
EE-403
POWER SYSTEMS-I

External: 50          L T P
Sessional: 50          3 1 0
Credits : 4

Note: Examiner shall set eight questions, four from Part-A and four from Part-B of the syllabus. Candidate will be required to attempt any five questions selecting at least two questions from Part A and two from Part B.

Part-A

1. **Introduction**
   Introduction to Power System, Representation of power system components, One line diagram and impedance diagram, Per unit system, Complex power.  
   (4-hours)

2. **Transmission-Line Parameters**
   Resistance, Conductance, Inductance: Solid Cylindrical Conductor, Inductance: Single-Phase Two-Wire Line and Three-Phase Three-Wire Line with Equal Phase Spacing, Composite Conductors, Unequal Phase Spacing, Bundled Conductors, Series Impedances: Three-Phase Line with Neutral Conductors and Earth Return, Electric Field and Voltage: Solid Cylindrical Conductor Capacitance: Single-Phase Two-Wire Line and Three-Phase Three-Wire Line with Equal Phase Spacing, Stranded Conductors, Unequal Phase Spacing, Bundled Conductors Shunt Admittances: Lines with Neutral Conductors and Earth Return Electric Field Strength at Conductor Surfaces and at Ground Level Parallel Circuit Three-Phase Lines  
   [Glover-Sarma: 4.1-4.13]  
   (10-hours)

3. **Transmission Lines: Steady-State Operation**
   [Glover-Sarma: 5.1-5.7]  
   (8-hours)

Part-B

4. **Symmetrical Faults**
   Three-Phase Short Circuit–Unloaded Synchronous Machine, Power System Three-Phase Short Circuits, Bus Impedance Matrix and its formation.  
   [Glover-Sarma: 7.1-7.5]  
   (8-hours)

5. **Symmetrical Components**
   Definition of Symmetrical Components, Sequence Networks of Impedance Loads, Sequence Networks of Series Impedances, Sequence Networks of Three-Phase Lines, Sequence Networks of Rotating Machines, Per-Unit Sequence Models of Three-Phase Two-Winding Transformers, Per-Unit Sequence Models of Three-Phase Three-Winding Transformers, Power in Sequence Networks  
   [Glover-Sarma: 8.1-8.8]  
   (6-hours)

6. **Unsymmetrical Faults**
   [Glover-Sarma: 9.1-9.5]  
   (8-hours)

**Text Book**


**Other Recommended Books**

Design/analysis projects relating to the following.
1. Determination of line parameters and sequence impedances of transmission lines.
2. Line loadability.
3. Steady state operation of transmission lines.
4. Symmetrical and Unsymmetrical power system faults.
Note: Examiner shall set eight questions four from each part. Candidate will be required to attempt any five questions selecting at least two questions from Part A and Part B.

**Part-A**

**TRANSISTOR AND FET AMPLIFIERS**
(09)

**FEEDBACK AMPLIFIERS AND OSCILLATORS**
(8)
Concept of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on Amplifier characteristics, Ideal feedback topologies, Voltage series, current series, voltage shunt, current shunt feedback circuits and their analysis, Oscillator, Condition of oscillations ,Types of oscillator: RC Phase Shift, Wein Bridge, Hartley,Colpitts and Crystal Oscillators.

**ACTIVE FILTER & TUNED AMPLIFIERS**
(10)
Advantages of active filters, classification of filters, response characteristics of butter worth, chebyshev and causal filters, first and second order low pass high pass, band pass and band stop filters. Tuned Amplifiers: single tuned, double tuned and stagger tuned amplifiers and their analysis

**Part-B**

**OPERATIONAL AMPLIFIER & ITS APPLICATION**
(10)
Differential Amplifier, Block diagram representation of a typical Op-amp, Ideal Op-amp characteristics, equivalent circuit. of op-amp, open loop op-amp configuration, practical op-amp, Input Offset voltage, Bias and offset currents, compensation, frequency response , CMRR, Supply voltage rejection ration (SVRR),Slew Rate, application of Op-amp Inverting and non inverting mode, differential mode, instrumentation amplifiers, comparator, Schmitt trigger, Clippers and Clamping Amplifiers, practical amplifiers, Sample and Hold Circuit, logarithmic amplifiers, Summation, Integrator and Differentiator

**PULSE CIRCUITS**
(10)
RC circuit as integrator and differentiator, Switching characteristics of a BJT, Astable, monostable and bistable multivibrators, Multivibrators with 555 IC timer,Schmit Trigger Circuits, voltage and current time base generators, Miller & bootstrap sweep generator

**Book recommended**

EE - 454
ANALOG ELECTRONICS LAB

Sessional: 50
Credits : 1

L T P 0 0 2

Note: At least eight experiments to be done.

1. To study the phase shift oscillator and find its frequency.

2. To study the frequency of a given crystal oscillator and measure the output.

3. To study WEIN-BRIDGE oscillator and determine its frequency.

4. To study voltage gain and frequency response of FET audio power amplifier.

5. To study the two stage RC coupled transistor amplifier.

6. To study the series and shunt feedback amplifiers and determine its frequency and
   i/p & o/p impedance.

7. To study the frequency response of Tuned Amplifier.

8. To study the Pspice Simulation software.

9. To study the frequency response of OP-Amp & simulate using P-spice.

10. To design Butter worth Low pass filter, High pass filter & simulate using P-spice.

11. To design Monostable & Free running Multivibrator using 555.