

# Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

Branch- Common to All Discipline

New Scheme Based On AICTE Flexible Curricula

BT401	Mathematics-III	3L-1T-0P	4 Credits
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**OBJECTIVES:** The objective of this course is to fulfill the needs of engineers to understand applications of Numerical Analysis, Transform Calculus and Statistical techniques in order to acquire mathematical knowledge and to solving wide range of practical problems appearing in different sections of science and engineering. More precisely, the objectives are:

- To introduce effective mathematical tools for the Numerical Solutions algebraic and transcendental equations.
- To enable young technocrats to acquire mathematical knowledge to understand Laplace transformation, Inverse Laplace transformation and Fourier Transform which are used in various branches of engineering.
- To acquaint the student with mathematical tools available in Statistics needed in various field of science and engineering.

**Module 1: Numerical Methods – 1: (8 hours):** Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

**Module 2: Numerical Methods – 2: (6 hours):** Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Simultaneous Linear Algebraic Equations by Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's, Gauss-Seidal, and Relaxation method.,

**Module 3: Numerical Methods – 3: (10 hours):** Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. RungeKutta method of fourth order for solving first and second order equations. Milne's and Adam's predictor-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

**Module 4: Transform Calculus: (8 hours):** Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method, Fourier transforms.

**Module 5: Concept of Probability: (8 hours):** Probability Mass function, Probability Density Function, Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution.

**Textbooks/References:**

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
7. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
8. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
9. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968. Statistics

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

## **New Scheme Based On AICTE Flexible Curricula**

### **Electrical & Electronics Engineering, IV-Semester**

#### **EX402 Electrical Machine-I**

**Transformer-I:** Working principle, e.m.f. equation, construction, phasor diagrams, equivalent circuit, voltage regulation, losses, separation of hysteresis and eddy current losses, efficiency, tests: open circuit and short circuit, load, Sumpner's test, Condition for maximum efficiency and regulation, Power and distribution transformer, all day efficiency, Excitation phenomenon. Autotransformer: working, advantages, its equivalent circuit and phasor diagram.

**Transformer-II:** Three phase transformer: its construction, groups and connections, their working and applications; Scott connection; Parallel operation of Transformers: application, advantages, requirement and load sharing; Tap changers, cooling, conservator and breather. Pulse and high frequency transformers.

**Three phase Induction Motor- I:** Working principle, construction, comparison of slip ring and squirrel cage motors, steady state analysis, phasor diagram and equivalent circuit, power flow diagram, torque-speed and power-speed characteristics, Losses and efficiency, No load and block rotor test, circle diagram

**Three phase Induction Motor-II:** Starting of squirrel cage and slip ring motors, power factor control, Cogging & Crawling, Double cage & Deep bar Induction Motor, impact of unbalanced supply and harmonics on performance, speed control, braking, Induction Generator. Applications

**Single Phase Motors:** Single Phase Induction motor; double revolving field theory, equivalent circuit and its determination, performance calculation, starting methods and types of single phase Induction motors: their working principle and applications, comparison with three phases Induction Motor. Single phase A.C. series motor, Servo motors, Linear Induction Motor

#### **List of Experiments (expandable)**

Experiments can cover any of the above topics, following is a suggestive list:

1. Perform turn ratio and polarity test on 1-phase transformer
2. Perform load test on a 1-phase transformer and plot its load characteristic
3. Perform OC and SC tests on a 1-phase transformer and determine its equivalent circuit. Also find its efficiency and regulation at different load and power factor.
4. Perform OC and SC tests on a 3-phase transformer and determine its equivalent circuit. Also find its efficiency and regulation at different load and power factor.
5. Perform Sumpner's test on two 1-phase transformer and determine its efficiency at various load.
6. Perform No-load and block rotor test on a 3-phase IM and determine its equivalent circuit.

7. Perform load test on a 3- phase IM and plot its performance characteristics.
8. Study various types of starters used for 3- IMs.
9. Perform No-load and block rotor test on a 1- phase IM and determine its equivalent circuit.

#### **TEXT BOOKS**

1. Electrical Machines by Nagrath and Kothari, McGraw-Hill
2. P.S.Bimbhra, Electrical Machines, Khanna Publishers

#### **REFERENCES**

1. V.Del Toro, "Electrical Machines & Power Systems", 1985, Prentice-Hall, Inc., Englewood Cliffs
2. S K Bhattacharya, Electrical Machines, McGraw-Hill
3. Ashfaq Hussain, Electrical Machines, Dhanpat Rai & Co
4. Langsdorf, A.C. Machines, McGraw-Hill
5. Samarajit Ghosh, Electrical Machines, Pearson

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### **Electrical & Electronics Engineering, IV-Semester**

#### **EX 403 Digital Electronics Logic Design**

##### **UNIT 1:**

**Number Systems and Codes:** Digital number systems, base conversion, Binary, Decimal, octal, Hexadecimal, number system with radix  $r$ , Gray codes. Alphanumeric codes – ASCII code and BCD codes, concept of parity, complement's &  $(r-1)$ 's, subtraction with complements, signed Binary numbers, Error Detecting & Correcting codes. Basic Theorems & Properties of Boolean algebra: AND, OR, NOT operators, laws of Boolean algebra, Demorgan's theorem, Boolean expression & logic diagram. Negative logic, Alternate logic gate representation (concept of bubbled gates) canonical and standard Forms (Minterms & Maxterms), sum of minterms & product of maxterms, conversion between canonical forms. Truth table & maps, 2,3,4,5 and 6 variable maps, solving digital problems using Maps, Don't care conditions, Tabular minimization. Sum of product & product of sum reduction, Exclusive OR & Exclusive NOR circuits, Parity generator & checkers.

##### **UNIT 2:**

**Combinational Circuits:** Design procedure, Adders (half and Full), subtractor (half and full) code convertors, Analysis of design, Universal building blocks, Implementation of any logic circuit with only NAND gates or with only NOR gates, Binary serial adder, parallel adder, serial/parallel adder, look ahead carry generator, BCD adder, Binary multiplier, Magnitude comparator, Decoder, Demultiplexer, Encoders, priority encoder, Multiplexers & implementation of combinational logic diagram.

##### **UNIT-3:**

**Sequential Logic Circuit :** Latches, SR latch with NAND & NOR gates, D latch, edge triggered flip flop, J-K flip flop, T flip flop, Master slave flip flop, Analysis of clocked sequential circuit, state table, state diagram, state reduction state equations, state assignments, flip flop excitation table & characteristic equations, Design procedure for sequential circuits, Design with state reduction, Applications of flipflop.

##### **UNIT 4:**

**Registers and Counters :** Asynchronous and Synchronous counter, counters with MOD numbers, Down counter, UP/DOWN counter, propagation delay in ripple counter, programmable counter, Pre-settable counter, BCD counter, cascading, counter applications, Decoding in counter, Decoding glitches, Ring Counter, Johnson counter, Rotate left & Rotate right counter, Registers – Buffer, Shift left, shift right, shift left/Right registers, parallel in parallel out, serial in serial out, parallel in serial out, serial in parallel out registers.

##### **UNIT 5:**

Random Access Memory, Timing waveform, Memory Decoding, Internal Construction, Coincident decoding, Address multiplexing, Read only memory – Combinational circuit

implementation, Type of ROMs, combinational PLDs, Programmable Logic Array (PLA), Programmable Array Logic (PAL), sequential programmable device. Analog to digital conversion – Ramp type, dual slope, integration, successive approximation, parallel conversion, parallel/ serial conversion, convertor specifications, Digital to Analog convertors – Binary weighted & R/2R D to A convertors.

**List of Experiments (Expandable):**

1. Verification of all the logic gates.
2. Design of BCD to Excess-3 code converter.
3. Implementation of NAND & NOR as Universal gate.
4. Design of RS, JK, T & D Flipflop.
5. Multiplexer / Demultiplexer based boolean function
6. Design of combinational circuit for the
  - (i) Half adder
  - (ii) Full adder
  - (iii) Half subtractor
  - (iv) Full subtractor
7. Design various A-D & D-A convertors.
8. Verify the truth table of SR flip flop
9. Verify BCD to seven segment decoder.

**References:**

1. A. Anand Kumar, Fundamentals of digital circuits, PHI
2. A K Maini, Digital Electronics, Wiley India
3. Thomas Blakeslee; Digital Design with standard MSI and LSI; Wiley Interscience
4. Jain RP; Modern digital electronics; TMH
5. M Mano; Digital Logic & Computer design; PHI
6. Tocci ; Digital Systems Principle & applications; Pearson Education Asia
7. Gothmann; Digital Electronics; PHI
8. Malvino, Leech; Digital Principles and applications – (TMH)
9. Floyd; Digital Fundamentals (UBS)
10. Nripendra N. Biswas; Logic Design Theory (PHI)
11. D.C. Green; Digital Electronics (Pearson Education Asia)
12. Subrata Ghoshal; Digital Electronics, Cengage

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### **Electrical & Electronics Engineering, IV-Semester**

#### **EX 404 Power System-I**

##### **UNIT 1:**

An overview of Electrical Energy Generation General background, structure and components of power network. Power generation – Introduction to conventional, non-conventional & distributed generation, Effect of transmission voltage on power system economy. Selection of size of feeder. Comparison of isolated versus interconnected power system. Problems associated with modern large interconnected power system. Power Plant Economics - Load curves, base load, peak load, load factor, demand factor, diversity factor, capacity factor, utilization factor, cost of electricity, capital cost, fuel and operation cost.

##### **UNIT 2:**

###### **Transmission Line Components & Under Ground Cabling:**

Inductance resistance and capacitance of transmission line, Calculation of inductance for 1- $\Phi$  and 3-  $\Phi$ , Single and double circuit line, Concept of GMR and GMD, Symmetrical & asymmetrical conduction configuration, Calculation of capacitance for 2 wire and 3 wire systems, Effect of ground or capacitance, Capacitance calculation for symmetrical and asymmetrical 1-phase and three phase, Single and double circuit line, Charging current, Transposition of line, Composite conductor, Skin and proximity effect, bundle conductor. Underground Cable Comparison of cables and overhead transmission lines, Classification of cables, requirement of cable construction, capacitance of single and multi-core cable, economic core diameter, dielectric stress in cable, Grading of cables, ionization of Heating of cables, Phenomena of dielectric losses and sheath loss in cables, Thermal resistance of cables.

##### **UNIT 3:**

###### **Transmission systems & performance of transmission line:**

Various systems of transmission, effect of system voltage, comparison of conductor materials required for various overhead systems. Short, Medium & long transmission line and their representation, Nominal T, Nominal  $\Pi$ , Equivalent T and equivalent  $\Pi$ , network models, ABCD constants for symmetrical & asymmetrical network, Mathematical solution to estimate regulation & efficiency of all types of lines. Surge Impedance, loading, Interpretation of long line equation and its equivalent equation. Tuned power lines. Power flow through transmission line, Circle diagram, Method of voltage control, Static & rotating VAR generator, transformer control.

##### **UNIT 4:**

Insulator & Mechanical design, types of conductors used in overhead transmission line, Types of line supports and towers, Distribution of conductors over transmission towers, Spacing between

conductors, Length of span and sag tension calculation for transmission line, Wind & ice loading, support of line at two different levels, string chart, Sag template, Stringing of conductor, Vibration and Vibration dampers. Insulator Materials used for transmission line insulations, Types of insulator for overhead transmission line failure of insulator, Voltage distribution of suspension insulator, String efficiency, Shielding and grading.

#### **UNIT 5:**

##### **Voltage control & Distribution system:**

AC single phase, 3 phase, 3wire & 4 wire distribution, Kelvin's law for most economical size of conductor Substation layout showing substation equipment, bus bar single bus bar and sectionalized bus bar, main and transfer for bus bar system, sectionalized double bus bar system, ring mains.

#### **REFERENCES**

1. John Grainger and William Stevenson, Power system Analysis, McGraw Hill.
2. C.L. Wadhwa, Electrical Power System Analysis, New Age International.
3. D.P. Kothari, I.J. Nagrath, Power System Engineering TMH II Ed. Reprint 2009.



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### **Electrical & Electronics Engineering, IV-Semester**

#### **EX 405 Control System**

##### **UNIT 1:**

Modeling of dynamic systems: Electrical, Mechanical and hydraulic systems, Concept of transfer function, Laplace Transform, State space description of dynamic systems: Open and closed loop systems, Signal flow graph, Mason's formula, Components of control systems: Error detectors (Synchros & Potentiometer), Servomotors (AC & DC), tachogenerators, power amplifier, stepper motors.

##### **UNIT 2:**

Time – domain analysis of closed loop systems: Test signals, time response of first and second order systems, Time domain performance specifications, Steady state error & error constants Feedback control actions: Proportional, derivative and integral control.

##### **UNIT-3:**

Stability: Routh-Hurwitz stability analysis Characteristics equation of closed loop system root loci, construction of loci, Effect of adding, poles and Zeros on the loci, Stability by root loci.

##### **UNIT-4:**

Frequency, Domain analysis, Bode plots, Effect of adding, poles and Zeros, Polar plot, Nyquist stability analysis, Relative stability: Gain and phase margins.

##### **UNIT-5:**

Design of control systems with PD/PI/PID Control in time domain and Frequency domain, lead-lag, Lag-lead compensation, Design of compensating networks. Solution of state equation: Eigen values & eigenvectors digitalization state transitive matrix

#### **List of experiments (Expandable)**

1. Time response of second order system.
2. Characteristics of Synchros.
3. Effect of feedback on servomotors.
4. Determination of transfer function of A-C servomotor
5. Determination of transfer function of D-C motor.
6. Formulation of PI & PD controller and study of closed loop responses of 1st and 2nd order dynamic systems.
7. State space model for classical transfer function using MATLAB.
8. Simulation of transfer function using operational amplifier.
9. Design problem: Compensating Networks of lead and lag.
10. Temperature controller using PID.

11. Transfer function of a DC generator.
12. Characteristics of AC servomotor.
13. Use of MATLAB for root loci and Bode plots of type-1, type-2 systems.
14. Study of analog computer and simulation of 1st order and 2nd order dynamic equations.
15. Formulation of proportional control on 1st order and 2nd order dynamic systems.
16. Feedback control of 3rd order dynamic Systems
17. Study of lead and lag compensating networks.
18. Effect of adding poles & zeros on root loci and bode plots of type-1, type-2 systems through MATLAB.

## REFERENCES

1. B.C. Kuo and Farid Golnaraghi, 'Automatic Control Systems', Wiley India.
2. M. Gopal, 'Control system engineering', McGraw Hill
3. K. Ogata, 'Modern Control Engineering', Pearson
4. D. Roy, Chaudhary, 'Modern Control Systems', PHI.
5. S. Salivahanan, R. Rengaraj, G.R. Venkatakrishnan, 'Control System Engineering', Pearson.
6. Stefani Shahian Savant, Hostetter, 'Design of feedback control systems' Oxford
7. B.S. Manke, Control system Engineering, Khanna Publishers

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### **Electrical & Electronics Engineering, IV-Semester**

#### **EX 406 Python**

##### **Python –Overview**

- **Introduction**
- **History**
- **Features**

##### **Python –Environment Setup**

- **Local Environment Setup**
- **Getting Python**
- **Installation of Python**
- **Use of IDE**

##### **Python –Basic Syntax**

- **Python Identifiers**
- **Reserved Words**
- **Lines & Indentation**
- **Multiline Statements**
- **Quotation in Python**
- **Comments & other useful constructs**

##### **Python –Variables**

- **Assigning Values to Variables**
- **Multiple Assignment**
- **Standard Data Types**
- **Python Numbers**
- **Python Strings**
- **Python Lists**
- **Python Tuples**
- **Data Type Conversion**

##### **Python –Basic Operators**

- **Types of Operators**
- **Arithmetic Operators**
- **Comparison Operators**
- **Assignment Operators**
- **Bitwise Operators**
- **Logical Operators**
- **Operator Precedence**

## **Python –Decision Making**

- **If statement Flowchart & Syntax**

## **Python –Loops**

- **Available loops flowchart**
- **Syntax**
- **Usage**

## **Python-Functions**

- **Defining a Function**
- **Syntax**
- **Calling a Function**
- **Function Arguments**
- **Anonymous Functions**

## **Python-Applications & Further Extensions**