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**

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 predicator-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

Biomedical Engineering, IV-Semester

BM402 Digital Circuits & Synthesis

UNIT-I

Review of semiconductor devices as switches, wave shaping circuits, time based generators. Number system. Number-based conventions, binary codes, Boolean function, and logic gates, DeMorgan's theorem. Simplification of Boolean function.

UNIT-II

Arithmetic circuits, half adders, full adders, combinational logic circuits, multiplexer, de-multiplexer, encoder, decoder, programmable, logic array, semiconductor memories, introduction to digital ICs.

UNIT-III

Sequential logic: Flip-Flop, counters, shift register.

UNIT-IV

Logic family: RTL, TTL, HTL, ECL, CMOS family.

UNIT-I V

D/A converter, A/D converters, Sample and Hold circuits**.** Multi-vibrators: astable, monostable, bistable,

Text Books:

- Pulse ,Digital and Switching waveforms by Millman and Taub
- Digital Principles and Applications by Malvino and Leach.
- Digital Electronics by Gothmann.

References:

- Integrated Electronics by Milliman&Halkias.
- An Engineering Approach to Digital Design by W. I. Fletcher.
- Digital Circuits & Logic Design by Morris Mano.

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Biomedical Engineering, IV-Semester

BM403 ANALOG ELECTRONICS

UNIT-I

Amplifiers at low frequencies: Review of analysis of single stage amplifiers using BJT and FET. Multistage amplifiers, cascading of amplifiers having different configurations, analysis of high input resistance circuits. Amplifiers at high freq: Hybrid π-model, $f_{a,}$ f_b, and f_t parameter, Miller's effect, gain-bandwidth product, frequency response of an *RC*-coupled amplifier, effect of cascading on gain and BW, calculation of 3-dB points, calculation of bandwidth.

UNIT-II

Feedback amplifier: general theory of feedback, characteristics of feedback, effect of feedback on amplifier characteristics and its parameters, analyses of different types of feedbacks in amplifiers. Oscillator: Tuned, phase shift, Wien-Bridge and crystal controlled oscillators.

UNIT-III

Operational amplifier: Differential amplifier, analyses of differential amplifiers, cascading of differential amplifiers,. Application of Op-amps in linear and nonlinear circuits.

UNIT-IV

Power supplies: review of regulators using zener-diode and series and shunt regulators, switching regulators, calculation and measurement of regulation characteristics, over current protection using limiting fold-back and crowbar protection, regulators using ICs, current regulators.

UNIT-V

Tuned *RF*-voltage amplifiers: concept of parallel; tuned circuits, Q factor, bandwidth, effect of loading, single and double tuned amplifiers, gain and bandwidth calculation, frequency response of under, critical and over damped circuit.

- **Text Books :**
- Microelectronics by J. Millman& A Grabel **,**Mc-Graw hill
- Integrated Electronics by Millman and Halkias, Mc-Graw hill
- Op Amp and Linear Integrated Circuits by R. A. Gayakwad, Prentice-Hall (India).

- **References:**
- Power Supplies and Regulators by B. S. Sonde., Tata Mc-Graw Hill ,1980
- Electronics Circuits by Schilling and Belove, Mc Graw Hill.
- Electronics Devices and Circuits by Robert Boylstad., Dorling Kendersley (India)Pvt Ltd.
- Electronics: Devices and Circuits by David Bell, Prentice-Hall (India).
- IC Voltage Regulators: National Semiconductor Data Book.

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Biomedical Engineering, IV-Semester

BM404 SIGNALS AND SYSTEMS

UNIT-I

Introduction to signals & systems

Sampling theorem - Discrete time signals and Systems - Properties of discrete systems , linearity , time invariance , causality, stability, LTI system convolution , correlation , autocorrelation.

UNIT-II

Difference equation representation of discrete systems

The Z transform , properties of Z Transform ,the inverse Z transform , Transfer function.

UNIT-III

Frequency Domain Analysis of discrete time signals:

Fourier Transform, Frequency response Function, Discrete Fourier series - Discrete Fourier Transform, properties , block convolution , Fast Fourier Transform ,decimation in , time FFT algorithms , decimation in , frequency FFT algorithms , FFT algorithms for N composite number- Spectrum analysis of bio signals. Case study: Frequency analysis of ECG signals.

UNIT-IV

UFIR Digital Filters Realizations

Direct , cascade , lattice forms ,FIR filter design using Fourier series , use of window functions like rectangular, raised Cosine, Kaiser, Triangular. Case study: Elementary ECG and EEG Filtering

UNIT-V

IIR Digital Filters Realizations

Direct , Cascade , Parallel forms , Analog filter approximations , Butterworth and Chebychev approximations , Frequencytransformation techniques. Case study: PCA and ICA for biomedical signals.

Text Book:

1. Digital Signal Processing by Oppenheim & R W Schafer, Prentice Hall (India)
2. Theory & Application of Digital Signal Processing by R Rabiner& B. Gold , Prentice Hall (India)

REFERENCE BOOKS

1. Digital Filters Analysis & Design by Andreas Antonion , Prentice Hall (India)
2. Digital Signal Processing by Andreas Antonion , Prentice Hall (India)
3. Digital Signal Processing by Manolakis and Proakis.,PHI.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

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Biomedical Engineering, IV-Semester

BM405 CLINICAL LABORATORY INSTRUMENTS

UNIT-I

Overview of medical laboratory Instrumentation. Classification of Analytical technique, and selection criteria, Electromagnetic radiation and its interaction with matter.

UNIT-II

Colorimeter, Spectro photometer: Laws of spectroscopy, absorption, emission and fluorescence spectroscopy. U-V, Visible and IR Spectrophotometers, various sources and detection systems.

UNIT-III

Mass spectrophotometer, flame photometers. NMR spectroscopy.

UNIT-IV

Chromatography : liquid and gas chromatography, X-Ray spectroscopy

UNIT-V

Various pathological and clinical laboratory instruments**,** particles counters, ion sensitive meters, centrifuges, chemistry and auto analyzers. Operating room maintenance and sterilization. Calibration & Preventive maintenance of laboratory instruments.

Text Books:

1. Principle of Instrumental Analysis, Skoog, Holler, Nieman, Brooks Cole; 5 edition (September 3, 1997)
2. Handbook of analytical Instruments, R.S. Khandpur, TMH.

References:

1. Instrumental methods of analysis, Willard, Merit and Dean. Van Nostrand
   Bioinstrumentation, John G. Webster, Wiley