B.Tech **ELECTRICAL ENGINEERING** (AKU Syllabus) SEMESTER-III

MA 1x03 MATHEMATICS – III L-T-P: 3-1-0 Credit : 4

1. ORDINARY DIFFERENTIAL EQUATIONS &SPECIAL FUNCTIONS : Series solution of differential equations (Frobenious method), Bessel's equation, Its solution, Bessel's function of first & second kind, Recurrence formula, Legendre's equation, Its solution, Legendre polynomials, Rodrigue's formula, Orthogonality of Legendre polynomial. **Lecture : 10**

2. PARTIAL DIFFERENTIAL EQUATION : Basic concept, 1st & 2nd order linear & quasi – linear partial differential equation, Classification of second order P.D.E., Boundary and initial conditions, wave equations, Separation of variables, use of fourier series, D'Alembert's solution of wave equation, Heat equation, Solution by fourier series. **Lecture : 10**

3. COMPLEX ANALYSIS - I : Function of complex variables – limit, continuity, differentiability and analyticity of functions Cauchy-Riemann equations, Laplace's equation, harmonic function, Cauchy's integral theorem, Cauchy's integral formula, Taylor's and Laurent series, Residues and its applications to evaluating real integrals. **Lecture : 10**

4. PROBABILITY & STATISTICS : Theorems on probability, including Baye's rule, Random variable – cumulative distribution function, Probability mass function, probability density function, Mathematical expectation, mean variance, moment, generating function & characteristics function, standard probability models Binomials, Poisson exponential, Weibull, normal and lognormal, sampling & sampling distribution, Chi- square and F distributions, large and small sample tests of significance. **Lecture : 12**

Text Books :

1. Advanced Engineering Mathematics by R.K.Jain & S.R.K. Iyengar
2. Higher engineering mathematics by B.S. Grewal
3. Fundamentals of mathematical statistics by V.K.Kapoor & S.C. Gupta- sultan & sons

References :

1. Advance Engineering Mathematics by E.Kreyszig 8th edition , John Wiley & sons
2. Complex variable and applications by Churchill & Brown –McGraw hill
3. Elements of Partial Differential equation by I.N.Sneddon - McGraw Hill
4. Introduction to Probability & Statistics for engineering by S.M.Ross – John Wiley and Sons, New York

EC 1x01 BASIC ELECTRONICS

L-T-P : 3-1-2 Credit : 5

1. PN junction diode : Depletion layer, barrier potential, forward and reverse bias, break down voltage, PIV characteristics of PN junction diode, knee voltage, ideal PN junction diode, junction capacitance, break down diode(zener diode). Photo diode and light emitting diode. **Lecture : 10**

2. Rectifiers and filters : Half wave and full wave rectifiers(centre tape and bridge), regulation ripple factor, R-C ,L-C and Pi filters. Clipping and clamping circuit, voltage multiplier. **Lecture : 8**

3. BJT introduction : Basic theory and operation of PNP and NPN transistors, characteristics of C-B,C-E,C-C configuration. **Biasing :** Base bias, emitter feedback bias, voltage divider bias, load line, operating point. Incremental analysis using h model. **Lecture : 12**

4. FET : introduction, operation, JFET parameters, JFET characteristics, JFET amplifiers.
MOS FET : Introduction, operation , MOSFET parameters . **Lecture : 4**

5. Feedback amplifiers. Lecture : 2

6. Integrated circuit : Characteristics of ideal, operational amplifiers. Application as inverting, non inverting amplifiers. Summer, difference, differentiator, integrator. **Lecture : 4**

7. Principle and application of SCR and UJT. **Lecture : 2**

Text Books :

1. Electronic devices and circuit theory by Boylestad and Nashelsky, Pearson
2. Electronic principle by Albert Malvino & Davis J Bates, TMH
3. Art of electronics by Paul H Horowitz, Oxford

Reference :

1. Introduction to electronic circuit design by Spencer, Pearson.
2. Device electronics for integrated circuits by Muller And Kamins With Masun Chan, Wiley student edition
3. Principles of electronics by V K Mehta and Rohit Mehta, Chand.
4. Electronic circuit and system by R J Smith. Wiley.

Basic Electronic Lab :

1. Introduction to DMM(digital multi meter)
2. Introduction to passive components(resistance, capacitance and inductors)
3. Introduction to cathode ray oscilloscope(CRO) - time period measurement., study of different wave forms, measurement of frequency of sinusoidal waveforms by Lissajou's figure.
4. Introduction to connectors- multi-strand wires and single strand wires and bread boards.
5. Study of output characteristics of diode, BJT,FET,UJT & SCR.

6. Application of diodes, BJT, FET, UJT & SCR-Clipping & clamping, rectification, RC coupled CE and CS FET amplifiers, relaxation oscillators
7. Application of μA 741- inverting amplifiers, summer amplifiers, difference amplifiers, integrator and differentiators.
Text Book : Lab manual by Maheshwari, PHI

CS 1X01 OBJECT ORIENTED PROGRAMMING
L- T- P : 3-0-3 Credit : 5
1. Introduction to C++ : Object Oriented Technology, Advantages of OOP, Input- output in C++, Tokens, Keywords, Identifiers, Data Types C++, Derives data types. The void data type, Type Modifiers, Typecasting, Constant, Operator, Precedence of Operators, Strings. **Lecture : 3**
2. Control Structures : Decision making statements like if-else, Nested if-else, goto, break, continue, switch case, Loop statement like for loop, nested for loop, while loop, do-while loop. **Lecture : 3**
3. Functions : Parts of Function, User- defined Functions, Value- Returning Functions, void Functions, Value Parameters, Function overloading, Virtual Functions. **Lecture : 3**
4. Classes and Data Abstraction : Structure in C++, Class, Build- in Operations on Classes, Assignment Operator and Classes, Class Scope, Reference parameters and Class Objects (Variables), Member functions, Accessor and Mutator Functions, Constructors, default Constructor, Destructors. **Lecture : 15**
5. Overloading & Templates : Operator Overloading, Function Overloading, Function Templates, Class Templates. **Lecture : 5**
6. Inheritance : Single and Multiple Inheritance, virtual Base class, Abstract Class, Pointer and Inheritance, Overloading Member Function. **Lecture : 5**
7. Pointers and Arrays : Void Pointers, Pointer to Class, Pointer to Object, The this Pointer, Void Pointer, Arrays. **Lecture : 6**
8. Exception Handling : The keywords try, throw and catch. Creating own Exception Classes, Exception Handling Techniques (Terminate the Program, Fix the Error and Continue, Log the Error and Continue), Stack Unwinding. **Lecture : 5**

ME 1x07 THERMODYNAMICS
L-T-P : 3-1-0 Credit : 4
1. Basic concept : Thermodynamic system and their properties, thermodynamic equilibrium, quasi-static and non quasi-static process, zeroth law and temperature equilibrium concepts. **Lecture : 3**
2. First law of thermodynamics : concept of heat and work, first law applied to closed and open system, internal energy and enthalpy, flow work, laws of perfect gas, specific heat, first law applied to flow & non flow process. **Lecture : 5**
3. Second law of thermodynamics : concept of heat engine, refrigerator, heat pump and their range of working temperature, Kelvin-planck's and claussius' statements and their equivalence, Entropy, calculation of entropy change for processes, reversibility, entropy principles, in equality of claussius, available and unavailable energy. **Lecture : 8**
4. Properties of pure substances : Properties of steam and process with steam, Use of steam tables and mollier charts. **Lecture : 4**
5. Helmhotz and Hibb's function, Maxwell's relation. **Lecture : 3**
6. Ideal cycles : Air standard cycles, Otto, Diesel, Dual and Brayton cycle, Comparison of Otto, Diesel and Dual cycle. **Lecture : 6**
7. Vapour cycle : Carnot and Rankine cycle, Regenerative and reheat cycle. **Lecture : 6**
8. Non reacting mixture : Mixture of two ideal gases and their properties. **Lecture : 2**
9. Psychometry : Air and water-vapour mixture and their properties, adiabatic saturation, Use of psychrometry charts, Simple introduction to psychrometric process. **Lecture : 5**

EC 1x08 SOLID STATE PHYSICS & DEVICES
L-T-P : 3-0-3 Credit : 5
1. History of development of electronic devices. **Lecture : 3**
2. Review of device physics : Photo-ionic emission, thermionic emission, gas discharge tubes, vacuum tubesdiodes, triodes, tetrads and pentodes. **Lecture : 3**
3. Crystal growth : Bulk and epitaxial **Lecture : 1**
4. IC technology : Oxidation, diffusion, ion implantation, lithography, thin film deposition (CVD, sputtering, evaporation,) process integration, process flow for PN diodes, BJT and MOSFETS fabrication. **Lecture : 5**
5. Physics and technology of classical diodes :
Semiconductor carrier modelling- bonding model, energy band model, carriers, band gap, carrier properties(effective mass, intrinsic carrier concentration, doping) density of states, Fermi function, equilibrium carrier concentration (formula for n and p and np product). Charge neutrality relationship, determination of Fermi level, carrier conc. Temperature dependence.

Carrier Action Drift Mobility Drift Current, Resistivity, Diffusion Current. Total current. relation between the diffusion constants. And mobility (Einstein's relationship). Recombination generation (Band to Band, R-G Centres, Auger, impact ionization). Equation of state Continuity equation, Minority Carrier Diffusion Equation.

PN Junction Diode Step junction, Built-in potential, Depletion width. Depletion Approximation .Electrostatic relationship (charge density depletion with potential , electric field)for Va=0 and Va<>0 Ideal Diode Equation(qualitative and quantitative derivation :Band Model , Assumptions Approximation .Boundary Condition),Deviation from Ideal (R-G Current, series Resistance ,High Level Injection).Junction Breakdown (Avalanche and Zener),Reverse Bias Junction Capacitance ,forward Bias Diffusion Capacitance ,Qualitative understanding of Turn on and Turn-off transients.

Zener Diode Backward diode Tunnel diodes Varactor diode, Schottky diode. **Lecture : 13**

6. Physics and technologies of BJT : operational considerations, modes and configurations, performance parameters (emitter efficiency, base transport factor, common base current gain, common emitter current gain and their derivation for an ideal transistor, deviation from ideal (base width modulation punch through, avalanche breakdown, geometrical effects, R-G current), small signal modelling, qualitative understanding of switch response. **Lecture : 6**

7. Physics and technologies of FET : Junction FET(theory of application, I-V relationship), MOS capacitor(energy band diagram, gate voltage relationship, capacitance- voltage characteristics), MOSFET (theory of operation, threshold voltage, I-V characteristics) NON IDEAL MOS (M-S work function difference, oxide charges, threshold adjustment and considerations) **Lecture : 5**

8. Physics and technologies of UJT and SCR : silicon controlled rectifier(theory of operation, switching consideration), uni junction transistor(theory of operation) **Lecture : 2**

9. Photonics : Photo diodes (pin and avlanche), solar cell, LED , solid state LASER diodes. **Lecture : 3**

10. CCD and CCD cameras. Lecture : 1

Text Book :

1. Solid sate electronic devices by Streetmen And Banerjee, Pearson:
2. Basic principles- semiconductor physics and devices by Nearmen,TMH
3. Semiconductor devices by Kano, Pearson

References :

1. Electronic Materials and Devices by Kasp. TMP.
2. Theory of Semiconductor Devices by Karl Hess, PHI.
3. Semiconductor Devices by Jasprit Singh, Wiley Student Edition.
4. Device electronics for Integrated Circuits by Muller & Kamins, Wiley Student Edition.

EE 1x42 ELECTRICAL MACHINES – 1

L-T-P: 3-0-3 Credit: 5

1. DC Generator : Constructional Feature and types of D.C. Machines, Types of armature winding, Action of Commutator, Principle of D.C. generator, Induced EMF, Armature reaction, Commutation, Compensating Winding and Inter Poles, External & Internal Characteristics of D.C. Generator, Critical Resistance, Critical Speed. **Lecture : 8**

2. D.C. Motor : Principle of D.C. Motors , Back EMF, Torque and Speed of D.C. Motors, Losses and Efficiency,
Characteristics, Starting and Speed Control of Various types of D.C. Motors **Lecture : 6**

3. Single Phase Transformer : Basic Principle, Types and Construction of Single Phase Transformer, EMF equation, Equivalent Circuits, Phasor Diagram, Losses and efficiency Testing, Voltage Regulation, per unit system, Losses and Efficiency, Parallel Operation of Single Phase Transformer. **Lecture : 10**

4. Auto Transformer : Working Principle, Saving of Conductor, Advantage and Disadvantage of Auto Transformer.
Lecture : 2

5. Three Phase Transformer : Introduction, Types, Phasor Group, Parallel Operation of three Phase Transformer,
Cooling of Transformer. **Lecture : 5**

6. Three Phase Induction Motor : Construction, Types and Principle of three Phase Induction Motors, Production of rotating field, slip, Equivalent Circuit and Phasor Diagram, Mechanical Power Developed, Maximum torque, Torque-Slip Characteristics, Losses and efficiency, Starting, Testing and speed control of Induction Motor. **Lecture : 11**

Text Book :

1. Electrical Machine by Samarjit Ghosh, Pearson Education Pvt. Ltd.
2. Electrical Machine by P.S Bimbra, Khanna Publication.
3. Electrical Machine by Nagrath, I . J and Kothari D.P. TMH.

Reference Book:

1. Electrical Machinery by Fitzgerald A.E