JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. EEE-I Sem
	L	T/P/D	C
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MATHEMATICS – III

Objectives: To learn
- Transforming the given variable coefficient equation (Cauchy's and Lagrange's) into the one with constant coefficients.
- Identifying ordinary points, singular points and regular singular points for the given ODE.
- Finding the series solution around a regular singular point.
- Solve the given ODE with variable coefficients by Frobenius method and test the convergence of its series solution.
- Series solutions for Legendre and Bessel differential equations, analyzing the properties of Legendre and Bessel polynomials.
- Differentiation and Integration of complex valued functions.
- Evaluation of integrals using Cahchy's integral formula.
- Taylor's series, Maclaurin's series and Laurent's series expansions of complex functions
- Evaluation of integrals using residue theorem.
- Transform a given function from z - plane to w – plane.
- Identify the transformations like translation, magnification, rotation and reflection and inversion.
- Properties of bilinear transformations.

UNIT – I:
Linear ODE with variable coefficients and series solutions(second order only): Equations reducible to constant coefficients-Cauchy's and Lagrange's differential equations. Motivation for series solutions, Ordinary point and Regular singular point of a differential equation , Transformation of non-zero singular point to zero singular point. Series solutions to differential equations around zero, Frobenius Method about zero.

Unit-II
Special Functions : Legendre's Differential equation, General solution of Legendre's equation, Legendre polynomials Properties: Rodrigue's formula – Recurrence relations, Generating function of Legendre's polynomials – Orthogonality. Bessel's Differential equation, Bessel functions properties: – Recurrence relations, Orthogonality, Generating function , Trigonometric expansions involving Bessel functions.

UNIT-III:
Complex Functions –Differentiation and Integration : Complex functions and its representation on Argand plane, Concepts of limit Continuity, Differentiability, Analyticity, Cauchy-Riemann conditions, Harmonic functions – Milne – Thompson method.   Line integral – Evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula.

UNIT-IV:
Power series expansions of complex functions and contour Integration: Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point –Isolated singular point – pole of order m – essential singularity. Residue – Evaluation of residue by formula and by Laurent series – Residue theorem. Evaluation of integrals of the type

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$

UNIT-V:
Conformal mapping: Transformation of z-plane to w-plane by a function, Conformal transformation. Standard transformations- Translation; Magnification and rotation; inversion and reflection,Transformations like e^{z} , log z, z^{2},   and Bilinear transformation. Properties of Bilinear transformation, determination of bilinear transformation when mappings of 3 points are given .

TEXT BOOKS:
1. Advanced Engineering Mathematics by Kreyszig, John Wiley & Sons.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

REFERENCES:
1) Complex Variables Principles And Problem Sessions By A.K.Kapoor, World Scientific Publishers
2) Engineering Mathematics-3 By T.K.V.Iyengar andB.Krishna Gandhi Etc
3) A Text Book Of Engineering Mathematics By N P Bali, Manesh Goyal
4) Mathematics for Engineers and Scientists, Alan Jeffrey, 6th Edit. 2013, Chapman & Hall/CRC

5) Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Person Education
6) Mathematics For Engineers By K.B.Datta And M.A S.Srinivas,Cengage Publications

Outcome: After going through this course the student will be able to:
Apply the Frobenius method to obtain a series solution for the given linear 2nd ODE.
Identify Bessel equation and Legendre equation and solve them under special conditions with the help of series solutions method. Also recurrence relations and orthogonality properties of Bessel and Legendre polynomials.
After going to through this course the student will be able to

- analyze the complex functions with reference to their analyticity, Integration using Cauchy's integral theorem,
- Find the Taylor's and Laurent series expansion of complex functions
- The conformal transformations of complex functions can be dealt with ease.

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FLUID MECHANICS AND HYDRAULIC MACHINERY

UNIT I
Fluid statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity surface tension-vapor pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure –measurement of pressure- Piezometer, U-tube and differential manometers.
Fluid kinematics: stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform, non uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow.

UNIT-II
Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.
Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line - hydraulic gradient line.
Measurement of flow: pilot tube, venturimeter, and orifice meter, Flow nozzle.

UNIT III
Basics of turbo machinery: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work don and efficiency, flow over radial vanes.
Hydroelectric power stations: Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements, mass curve (explanation only) estimation of power developed from a given catchment area; heads and efficiencies.

UNIT IV
Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies , hydraulic design –draft tube- theory- functions and efficiency.
Performance of hydraulic turbines: Unit and specific quantities, Model Analysis, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank,

UNITV
Centrifugal pumps: classification, working, work done – manomertic head, static head- losses and efficiencies-specific speed- Model analysis, pumps in series and parallel-performance characteristic curves, NPSH, water hammer

TEXT BOOKS:
1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.
REFERENCE BOOKS:
1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
4. Instrumentation for Engineering Measurements by James W. Dally, William E. Riley ,John Wiley & Sons Inc. 2004 (Chapter 12 – Fluid Flow Measurements)

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II Year B.Tech. EEE-I Sem	L	T/P/D	C
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ELECTRONIC DEVICES AND CIRCUITS

Objectives:
This is a fundamental course, basic knowledge of which is required by all the circuit branch engineers This course focuses:
- To familiarize the student with the principle of operation, analysis and design of Junction diode, BJT and FET amplifier circuits.
- To understand diode as rectifier.
- To study basic principle of filter circuits and various types.

UNIT -I:
P-N Junction Diode: Qualitative Theory of P-N Junction, P-N Junction as a Diode, Diode Equation, Volt-Ampere Characteristics, Temperature dependence of VI characteristic, Ideal versus Practical – Resistance levels (Static and Dynamic), Transition and Diffusion Capacitances, Diode Equivalent Circuits, Load Line Analysis, Breakdown Mechanisms in Semiconductor Diodes, Zener Diode Characteristics.
Special Purpose Electronic Devices: Principle of Operation and Characteristics of Tunnel Diode (with the help of Energy Band Diagram), Varactor Diode, SCR and Semiconductor Photo Diode.

UNIT -II:
Rectifiers and Filters : The P-N junction as a Rectifier, Half wave Rectifier, Full wave Rectifier, Bridge Rectifier, Harmonic components in a Rectifier Circuit, Inductor Filters, Capacitor Filters, L- Section Filters, π- Section Filters, Comparision of Filters, Voltage Regulation using Zener Diode.

UNIT -III:
Bipolar Junction Transistor and UJT: The Junction Transistor, Transistor Current Components, Transistor as an Amplifier, Transistor Construction, BJT Operation, BJT Symbol, Common Base, Common Emitter and Common Collector Configurations, Limits of Operation , BJT Specifications, BJT Hybrid Model, Determination of h-parameters from Transistor Characteristics, Comparison of CB, CE, and CC Amplifier Configurations, UJT and Characteristics.

UNIT -IV:
Transistor Biasing and Stabilization: Operating Point, The DC and AC Load lines, Need for Biasing, Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector - Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization against variations in V_{BE} and β, Bias Compensation using Diodes and Transistors, Thermal Runaway, Thermal Stability, Analysis of a Transistor Amplifier Circuit using h-Parameters.

UNIT -V:
Field Effect Transistor and FET Amplifiers
Field Effect Transistor: The Junction Field Effect Transistor (Construction, principle of operation, symbol) – Pinch-off Voltage - Volt-Ampere characteristics, The JFET Small Signal Model, MOSFET (Construction, principle of operation, symbol), MOSFET Characteristics in Enhancement and Depletion modes.
FET Amplifiers: FET Common Source Amplifier, Common Drain Amplifier, Generalized FET Amplifier, Biasing FET, FET as Voltage Variable Resistor, Comparison of BJT and FET.

TEXT BOOKS:
1. Millman's Electronic Devices and Circuits – J. Millman, C.C.Halkias, and Satyabrata Jit, 2 Ed.,1998, TMH.
2. Electronic Devices and Circuits – Mohammad Rashid, Cengage Learing, 2013
3. Electronic Devices and Circuits – David A. Bell, 5 Ed, Oxford
REFERENCE BOOKS:
1. Integrated Electronics – J. Millman and Christos C. Halkias, 1991 Ed., 2008, TMH.
2. Electronic Devices and Circuits - K. Lal Kishore, 2 Ed., 2005, BSP.
3. Electronic Devices and Circuits – B. P. Singh, Rekha Singh, Pearson, 2 Ed, 2013.
4. Electronic Devices and Circuits – Anil K. Maini, Varsha Agarwal, 1 Ed., 2009, Wiley India Pvt. Ltd.
5. Electronic Devices and Circuits – S.Salivahanan, N.Suresh Kumar, A.Vallavaraj, 2 Ed., 2008, TMH.
6. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, 9 Ed., 2006, PEI/PHI.

Course Outcomes:
At the end of the course, the student will be able to:
- Understand and Analyse the different types of diodes, operation and its characteristics
- Design and analyse the DC bias circuitry of BJT and FET.
- Design biasing circuits using diodes and transistors.
- To analyze and design diode application circuits, amplifier circuits and oscillators employing BJT, FET devices.

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II Year B.Tech. EEE-I Sem	L	T/P/D	C
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ELECTRICAL CIRCUITS

Objective:
This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical Engineering discipline. The emphasis of this course if laid on the basic analysis of circuits which includes single phase circuits, magnetic circuits, theorems and network topology.

UNIT –I:
Introduction to Electrical Circuits: Circuit Concept, R-L-C Parameters, Voltage and Current Sources, Independent and Dependent Sources, Source Transformation, Voltage – Current relationship for Passive Elements (for different input signals –Square, Ramp, Saw tooth and Triangular). Kirchhoff's Laws, Network Reduction Techniques – Series, Parallel, Series Parallel, Star –to-Delta or Delta-to-Star Transformations, Nodal Analysis, Mesh Analysis, Super node and Super mesh for DC Excitations.

UNIT –II:
Single Phase A.C. Circuits: R.M.S. and Average values and form factor for different periodic wave forms, Steady State Analysis of R, L and C (in Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation, Concept of Reactance, Impedance, Susceptance and Admittance, Phase and Phase difference, Concept of Power Factor, Real and Reactive powers, J-notation, Complex and Polar forms of representation, Complex power.

UNIT –III:
Locus diagrams, Resonance and Magnetic circuits: Locus diagrams - series R-L, R-C, R-L-C and parallel combination with variation of various parameters - Resonance-series, parallel circuits, concept of band width and Q factor. Magnetic circuits-Faraday's laws of electromagnetic induction-concept of self and mutual inductance-dot convention-coefficient of coupling-composite magnetic circuit-analysis of series and parallel magnetic circuits.

UNIT –IV:
Network Topology: Definitions, Graph, Tree, Basic cutset and Basic Tie set Matrices for Planar Networks, Loop and Nodal methods for analysis of Networks with Dependent & Independent Voltage and Current Sources, Duality & Dual Networks.

UNIT –V:
Network Theorems (With A.C. & D.C): Tellegen's, Superposition, Reciprocity, Thevinin's, Norton's, Maximum Power Transfer, Milliman's and Compensation theorems for D.C excitations.

TEXT BOOKS:
1. Electric Circuits - A.Chakrabarhty, Dhanipat Rai & Sons.
2. Network analysis - N.C Jagan and C. Lakhminarayana, BS publications.

REFERENCE BOOKS:
1. Engineering Circuit Analysis - William Hayt ,Jack E. Kemmerly, S M Durbin, Mc Graw Hill Companies.
2. Electric Circuit Analysis - K.S.Suresh Kumar, Pearson Education.
3. Electrical Circuits - David A.Bell, Oxford University Press.
4. Network Analysis and Circuits - M.Arshad, Infinity Science Press.
5. Circuits - A.Bruce Carlson, Cengage Learning.
6. Electrical Circuits: An Introduction - KCA Smith & RE Alley, Cambridge University Press.

Outcome:
After going through this course the student gets a thorough knowledge on basics of circuit concepts, electrical parameters, single phase AC circuits, magnetic circuits , resonance, network topology and network theorems with which he/she can able to apply the above conceptual things to real-world problems and applications.

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II Year B.Tech. EEE-I Sem   L   T/P/D   C
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ELECTROMAGNETIC FIELDS

Objective:
The objective of this course is to introduce the concepts of electric field and magnetic fields and their applications which will be utilized in the development of the theory for power transmission lines and electrical machines.

UNIT – I:
Electrostatics: Electrostatic Fields – Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge – Work done in moving a point charge in an electrostatic field – Electric Potential – Properties of potential function – Potential gradient – Guass's law – Application of Guass's Law – Maxwell's first law, div (D)=ρv Laplace's and Poison's equations – Solution of Laplace's equation in one variable.

UNIT – II:
Conductors, Dielectrics and Capacitance: Electric dipole – Dipole moment – potential and EFI due to an electric dipole – Torque on an Electric dipole in an electric field – Behavior of conductors in an electric field – Conductors and Insulators. Electric field inside a dielectric material – polarization – Dielectric – Conductor and Dielectric – Dielectric boundary conditions, Capacitance – Capacitance of parallel plate and spherical and co-axial capacitors with composite dielectrics – Energy stored and energy density in a static electric field – Current density – conduction and Convection current densities – Ohm's law in point form – Equation of continuity.

UNIT – III:
Magneto Statics: Static magnetic fields – Biot-Savart's law –- Magnetic field intensity (MFI) – MFI due to a straight current carrying filament – MFI due to circular, square and solenoid current – Carrying wire – Relation between magnetic flux, magnetic flux density and MFI – Maxwell's second Equation, div(B)=0.
Ampere's circuital law and its applications: viz. MFI due to an infinite sheet of current and a long current carrying filament – Point form of Ampere's circuital law – Maxwell's third equation, Curl (H)=Jc, Field due to a circular loop, rectangular and square loops.

UNIT-IV:
Force in Magnetic Fields And Magnetic Potential : Magnetic force - Moving charges in a Magnetic field – Lorentz force equation – force on a current element in a magnetic field – Force on a straight and a long current carrying conductor in a magnetic field – Force between two straight long and parallel current carrying conductors – Magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field. Scalar Magnetic potential and its limitations – vector magnetic potential and its properties – vector magnetic potential due to simple configurations – vector Poisson's equations. Self and Mutual inductance – Neumans's formulae – determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and density in a magnetic field. Introduction to permanent magnets, their characteristics and applications.

UNIT – V:
Time Varying Fields : Time varying fields – Faraday's laws of electromagnetic induction – Its integral and point forms – Maxwell's fourth equation, Curl (E)=-∂B/∂t – Statically and Dynamically induced EMFs – Simple problems -Modification of Maxwell's equations for time varying fields – Displacement current .

TEXT BOOKS:
1. "Engineering Electromagnetics" William H. Hayt & John. A. Buck McGraw-Hill Companies.
2. "Electro magnetic Fields", Sadiku, Oxford Publications.

REFERENCES:
1. "Introduction to Electro Dynamics",D J Griffiths, Prentice-Hall of India Pvt.Ltd.
2. "Electromagnetic Fields", Y Mallikarjuna Reddy, Universities Press.
3. "Electromagnetics",J. D Kraus Mc Graw-Hill companies.
4. "Electromagnetism-Problems with solutions", Ashutosh Pramanik, PHI Learning.
5. "Electromagnetics-Problems and solutions", William H. Hayt & John. A. Buck McGraw-Hill Companies.

Outcome:
After going through this course the student gets a thorough knowledge on vector algebra, 3-dimensional co-ordinate systems, electrostatics, behavior of conductors insulators semiconductors dielectrics and capacitance, magneto statics, time-varying fields, interaction between electricity and magnetism, different laws, Maxwell's equations, with which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

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II Year B.Tech. EEE-I Sem	L	T/P/D	C
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ELECTRICAL MACHINES - I

Objective:
Electrical machines course is one of the important courses of the Electrical discipline. In this course the different types of DC generators and motors which are widely used in industry are covered and their performance aspects will be studied.

UNIT – I:
Electromechanical Energy Conversion: Electromechanical Energy conversion – forces and torque in magnetic field systems – energy balance – energy and force in a singly excited magnetic field system, determination of magnetic force - co-energy – multi excited magnetic field systems.

UNIT – II:
D.C. Generators & Armature Reaction : D.C. Generators – Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature – E. M.F Equation – Problems
Armature reaction – Cross magnetizing and de-magnetizing AT/pole – compensating winding – commutation – reactance voltage – methods of improving commutation.

UNIT – III:
Types of D.C Generators & Load Characteristics : Methods of Excitation – separately excited and self excited generators – build-up of E.M.F - critical field resistance and critical speed - causes for failure to self excite and remedial measures. Load characteristics of shunt, series and compound generators – parallel operation of d.c series generators – use of equalizer bar and cross connection of field windings – load sharing.

UNIT – IV:
D.C. Motors & Speed Control Methods: D.C Motors – Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Armature reaction and commutation.
Speed control of DC Motors: Armature voltage and field flux control methods. Ward-Leonard system. Principle of 3 point and 4 point starters – protective devices.

UNIT – V:
Testing of D.C. Machines: Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency. Methods of Testing – direct, indirect and regenerative testing – brake test – Swinburne's test – Hopkinson's test – Field's test – Retardation test – separation of stray losses in a DC motor test**.**

TEXT BOOKS:
1. Electrical Machines, P.S. Bimbra, Khanna Publishers.
2. Principles of Electrical Machines, V. K. Mehta, Rohit Mehta, S. Chand Publishing.

REFERENCE BOOKS:
1. Electric Machines, Mulukutla S. Sarma, Mukesh K. Pathak, Cengage Learning.
2. Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers.
3. Fundamentals of Electric Machines, B. R. Gupta, Vandana Singhal, New Age International Publishers.
4. Electrical Machines, M. V. Deshpande, PHI Learning Private Limited.
5. Electrical Machines, R. K. Srivastava, Cengage Learning.

Outcome:
After going through this course the student gets a thorough knowledge on electromechanical energy conversion, construction operation characteristics   speed control methods and testing of different types of DC Generators and DC motors, with which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

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II Year B.Tech. EEE-I Sem	**L**	**T/P/D**	**C**
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FLUID MECHANICS AND HYDRAULIC MACHINES LAB

1. Calibration of Venturimeter.

2. Calibration of Orifice meter.

3. Determination of friction factor for a given pipe line.

4. Determination of loss of head due to sudden contraction in a pipeline.

5. Verification of Bernoulli's theorem.

6. Impact of jets on Vanes.

7. Performance Test on Pelton Wheel.

8. Performance Test on Francis Turbine.

9. Performance Test on Kaplan Turbine.

10. Performance Test on Centrifugal Pump.

11. Performance Test on Multi Stage Centrifugal Pump.

12. Performance Test on Reciprocating Pump.

Note: Any 10 of the above 12 experiments are to be conducted.

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II Year B.Tech. EEE-I Sem	L	T/P/D	C
	-	-/3/-	2

ELECTRONIC DEVICES AND CIRCUITS LAB

PART A: (Only for Viva-voce Examination)

Electronic Workshop Practice (In 3 Lab Sessions):
1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCB's
2. Identification, Specifications and Testing of Active Devices, Diodes, BJT's, Low power JFET's, MOSFET's, Power Transistors, LED's, LCD's, SCR, UJT.
3. Study and operation of
   i. Multimeters (Analog and Digital)
   ii. Function Generator
   iii. Regulated Power Supplies
   iv. CRO.

PART B: (For Laboratory Examination – Minimum of 10 experiments)

1. Forward & Reverse Bias Characteristics of PN Junction Diode.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Input & Output Characteristics of Transistor in CB Configuration and h-parameter calculations.
4. Input & Output Characteristics of Transistor in CE Configuration and h-parameter calculations.
5. Half Wave Rectifier with & without filters.
6. Full Wave Rectifier with & without filters.
7. FET characteristics.
8. Design of Self-bias circuit.
9. Frequency Response of CC Amplifier.
10. Frequency Response of CE Amplifier.
11. Frequency Response of Common Source FET amplifier .
12. SCR characteristics.
13. UJT Characteristics

PART C: Equipment required for Laboratories:

1.	Regulated Power supplies (RPS)	-0-30 V
2.	CRO's	-0-20 MHz.
3.	Function Generators	-0-1 MHz.
4.	Multimeters	
5.	Decade Resistance Boxes/Rheostats	
6.	Decade Capacitance Boxes	
7.	Ammeters (Analog or Digital)	-0-20 μA, 0-50μA, 0-100μA, 0-200μA, 0-10 mA.
8.	Voltmeters (Analog or Digital)	-0-50V, 0-100V, 0-250V
9.	Electronic Components	-Resistors, Capacitors, BJTs, LCDs, SCRs, UJTs, FETs, LEDs, MOSFETs,

Diodes – Ge & Si type,

Transistors – NPN, PNP type)