Sr. No. 8 **Syllabus for SSA(Additional SSO)**

1.Basic Electrical Engineering

a) **DC Circuits** : Definition and units of electric current, potential and potential difference, Ohms law, resistance,conductance,resistivity and conductivity,their units and dependence on temperature in conductor, Power and energy,heating effect of electric current and conversion of mechanical to electrical units and vice versa. Kirchhoff's voltage and current laws and their applications in simple DC circuits, Series and parallel combination of resistors, wattage consideration, Simple problems.

b) **Electro Magnetism :** Concept of magnetic field production by flow of current, Oersteds experiment, concept of magneto motive force(MMF), Flux, reluctance, permeability, Analogy between electric and magnetic circuits, Force on a moving charge and current in a magnetic field, force between two current carrying parallel conductors, Magnetic field around a current carrying straight conductor, circular loop and solenoids, Faradays laws, Lenzs Law and rules of electromagnetic induction, principals of self and mutual induction, self mutually induced e.m.f., simple numerical problems, energy stored in magnetic field, concept of current growth decay and time constant in an inductive (RL) circuit, Energy stored in an inductor, series and parallel combination of inductors, Concept of hysteresis loop.

c) **AC Circuits** :Concepts of generation of alternating voltage and current, difference between AC and DC, Terms related to AC waves-instantaneous, average, RMS and peak values, Form Factor (definition only). Equation of sinusoidal waveform, representation of alternating quantities, concept of phase difference, Representation of sinusoidal quantities by phasor diagram of alternating voltage applied to a pure resistance, pure inductance and pure capacitance, phasor diagrams form simple R,L,C circuits (Series and parallel) concept of impedence, impedence triangle,

phase angle, Numerical problems, phaor diagram for RL, RC series circuits.

d) **Network Theorems** :Thevenin's theorem, Norton's theorem, superposition theorem, maximum power transfer theorem, application of network theorems in solving DC circuit problems.

2. Electrical Circuits and Systems

a) **DC Circuits** : Concepts of electricity, Definitions& units of the following terms- Potential and potential Difference, Current, Resistance, Electrical Power, Electrical energy, Ohm's law and its practical applications, Effect of temperature on resistance, Connection of resistance in series and parallel, Kirchhoff's law&their application to simple circuits.

b) **Classification of Materials** : Classification of materials conducting, semi conducting, insulating and magnetic materials.

c) **Active and passive components** : Introduction to active and passive components, fixed and variable resistances, their various types,fixed and variable capacitors, their various types and important specifications and colour codes, Voltage and Current sources-concept of constant voltage and constant current sources, symbol and graphical representation.

d) **AC Fundamentals** : Concepts of terms related with AC waves, RMS and average values of Sine waves, Concept of phase and phase difference, Alternating voltage applied to pure resistance, alternating voltage applied to pure inductance, Alternating voltage applied to pure capacitance,R-L Series circuit, R-C Series Circuit, Concept of impedance and impedance triangle, Concept of Power and p.f in AC Circuits.

e) **Transformers** : Overview of electromagnetic induction, self and mutual induction, construction and working, principle of single phase transformer, construction of different types(core and shell type) of transformers, turn ratio, efficiency and rating, Different

types of transformers: auto transformers, single winding, double winding, pulse and isolation transformers.

f) **DC Machines** : Working principle of DC generator, types of DC generation and their applications, Working principle of DC motors, types of DC motor and their applications, concept of back emf, use of starters for DC motors, three point and four point starters.

g) **AC Machines** : Working principle of single phase induction motors, their construction and starting(resistance start, capacitor start, capacitor run,capacitor start and run), introduction to other types of motors(reluctance, hysteresis, universals motors, stepper motor and servo motors.

h) **Semi Conductor diode**: PN junction, use of a diode in rectifiers, half wave, full wave and bridge rectifiers, zener diode and its applications, light emitting diode(LED), liquid crystal display(LCD)

i) **Transistors** : Introduction to a transistor. Working of a PNP and NPN transistor, transistor configuration, biasing of a transistor, amplifying action of a transistor, field effect transistor: FET, JFET, MOSFET, their characteristics and applications, uni-junction transistors (UJT)

j) **Power Supplies** : Working principles of constant voltage transformers (CVT's) and uninterrupted power supplies (UPS) and their ratings.

3.Electrical and Electronics Engineering

a) **Basic Electromagnetic Laws:** Electromagnetic Induction Faradays Law, Lenz Law, Flemings Rules, Principles of AC Circuits, Alternating EMF, Definition of Cycle, Frequency Amplitude and Time period, Instantaneous, Average , RMS and Maximum Value of Sinusoidal Wave, Form Factor and peak Factor, Concepts of Phase and phase difference, Concepts of Resistance,Inductance an Capacitance in Simple AC Circuit, Power Factor and

Improvement of Power Factor, By Use of Capacitors, Concept of three Phase System, star and Delta Connections, Voltage and Current Relationship (No Derivation)

b) **Measuring Instruments** : Principle and construction of Instruments used for Measuring Current, Voltage and Current Voltage, Power and Energy.

c) **DC Machines** : Working, principles and construction of d.c. machines (d.c.motors and generator) Performances and characterization of different types of dc machines(speed load, torque load and speed-load characterization), application of dc machines.

d) **Transformers** : Working Principle and Construction of Single Phase transformers, Transformer Rating, EMF Equation, Losses and Efficiency, Cooling of Transformers, Isolation of Transformers, CVT, Auto Transformer (Brief Idea), Applications.

e) **Induction Machines** : Working Principle and Construction of 3-Phase Induction Motors, Types of Induction, Motor-Slip Rings Squirrel Cage, Slip and Torque-Speed Characteristics of Induction Motor, Operation Of Induction Machine as induction generator, Application of 3-Phase Induction Machines, Concept Of Single Phase Induction Motor and Applications.

f) **Synchronous Machines** : Alternators-Working Principles, Types and Construction Detail Synchronous Motor Working Principle and its Application as synchronous Condenser

4.Electrical Technology and Electronics

a) **Basic Concepts** : Concepts of Electricity, Definitions and units of Potential and Potential Difference, Current, resistance, Capacitance, Inductance, Electrical Power, Electrical Energy, Ohm's Law and its practical applications, Effects of temperature on resistance, Connection of Resistance in series and parallel, Kirchhoff's Law and their applications to Simple Circuits.

b) **Electrical Safety:** Electrical Shock and Precautions against shock, Treatment of Electric Shock, Concepts of Fuses and their Classification, Selection and Application, Concept of Earthing and various types of Earthing, Application of MCBs and ELCBs.

c) **AC Fundamentals** : Concept of Alternating Voltage and Alternating Current, Difference between AC and DC, Concepts of terms related with AC Waves, RMS and Average Values of Sine Waves, Concept of Phase and Phase difference, Concept of Single Phase and Three Phase Supply, Alternating Voltage applied to pure Resistance, pure Inductance and pure Capacitance, R-L Series Circuits, Concept of Power and power Factor in AC Circuit.

d) **Electromagnetic Induction** : Concept of Magnetic Field, Concept of Magnetic Flux, Reluctance, Magneto motive force (MMF), Permeability, Self and mutual Induction, Effects of Conductor Moving in a Magnetic Field.

e) **Electrical Machine** : Principals, Construction and Working of Single Phase Motors, Three Phase Motors , And starters

f) **Transformers** : Principles, Construction and Working of a Transformer,Types of transformers, Applications of Transformers.

g) **Basic Electronics :** Basic Idea of Semiconductors-P and n Types, Diodes, Zener Diodes and their applications, Transistors-Pnp and Npn, Their Characteristics and uses, Characteristics and application of Thyristor, Characteristics and Application of Servo Motors.

5. Electrical Machines

a) **Generalized system of electrical machine** : Definition of motor and generator, Basic principle of a motor and generator, Torque due to interaction of two magnetic fields and the concept of torque angle, basic electromagnetic laws, EMF induced in a coil rotating in a magnetic field, Elementary conceptof an electrical machine, Common features of rotating electrical machines

b) **Transformers :** Principle of operation and constructional details of Single phase transformer, Core Type and shell type transformers, e.m.f. equation., Working of Transformers on no load and on load, losses in transformers efficiency, all day efficiency and condition for maximum efficiency of transformer, Voltage regulation of a transformer (no mathematical treatment)

c) **DC machines** : Constructional features and principle of working, Function of theCommutator for motoring and generating action, Types of armature winding(lap and wave- no detailed diagram), factors determining induced e.m.f., Factors determining electromagnetic torque, Relationship between terminal Voltage and induced e.m.f. for different DC machines, Factors determining Speed of DC motors, speed control methods, Performance Characteristics of different DC Machines(working as motors and generators), Starting of DC motors and starters, Application of DC motors.

d) **AC Machines** : Brief introduction about three phase induction motors, its principle of operation, Types of induction Motors and constructional feature of squirrel cage and slip ring motors, Starting of three phase induction motors: Star Delta and DOL(direct-on-line) starters, reversal of direction of rotation of three motors, Application of Induction Motors, Introduction of Synchronous Machines- alternators and its principle of operation synchronous motors and their applications.

e) **Single phase and Fractional Kilowatt motors** : Introduction, Principle of operation of single phase motors, Types of single Phase Induction motors and their constructional details(i.e. split phase capacitor start, capacitor start and run, shaded pole and reluctance start motor), Single Phasesynchronous motors-reluctance motors (hysteresis motors), Commutator type single phase motors-Repulsion induction motor, AC series motor and universal motors.

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