

## APPENDIX I

### **SCHEME AND SYLLABUS OF EXAMINATION FOR THE PURPOSE OF FILLING UP THE POST OF ASSISTANT ENGINEER (ELECTRICAL).**

The Examination will consist of 4 papers:-

PAPERS	SUBJECT	FULL MARKS	TIME ALLOWED
PAPER – I	GENERAL ENGLISH	50	1 HOUR
PAPER - II	GENERAL KNOWLEDGE	50	1 HOUR
PAPER - III	ELECTRICAL ENGINEERING-I	300	3 HOURS
PAPER – IV	ELECTRICAL ENGINEERING-II	300	3 HOURS
VIVA-VOCE	80 MARKS		

### **SYLLABUS**

#### PAPER – I GENERAL ENGLISH

- i) Comprehension
- ii) Composition and Grammar

#### PAPER –II GENRAL KNOWLEDGE

- i) Current events of Local, National & International importance.
- ii) National level Schemes & Projects undertaken by Government of India.

### **PAPER III Electrical Engineering**

#### **1. EM Theory**

Electric and magnetic fields. Gauss's Law and Amperes Law. Fields in dielectrics, conductors and magnetic materials. Maxwell's equations. Time varying fields. Plane-Wave propagating in dielectric and conducting media. Transmission lines.

#### **2. Electrical Materials**

Band Theory, Conductors, Semi-conductors and Insulators. Super-conductivity. Insulators for electrical and electronic applications. Magnetic materials. Ferro and ferri magnetism. Ceramics, Properties and applications. Hall effect and its applications. Special semi

conductors.

### **3. Electrical Circuits**

Circuits elements. Kirchoff's Laws. Mesh and nodal analysis. Network Theorems and applications. Natural response and forced response. Transient response and steady state response for arbitrary inputs. Properties of networks in terms of poles and zeros. Transfer function. Resonant circuits. Three-phase circuits. Two-port networks. Elements of two-element network synthesis.

### **4. Measurements and Instrumentation**

Units and Standards. Error analysis, measurement of current, Voltage, power, Power-factor and energy. Indicating instruments. Measurement of resistance, inductance, Capacitance and frequency. Bridge measurements. Electronic measuring instruments. Digital Voltmeter and frequency counter. Transducers and their applications to the measurement of non-electrical quantities like temperature, pressure, flow-rate displacement, acceleration, noise level etc. Data acquisition systems. A/D and D/A converters.

### **5. CONTROL SYSTEMS.**

Mathematical modelling of physical systems. Block diagrams and signal flow graphs and their reduction. Time domain and frequency domain analysis of linear dynamical system. Errors for different type of inputs and stability criteria for feedback systems. Stability analysis using Routh-Hurwitz array, Nyquist plot and Bode plot. Root locus and Nicols chart and the estimation of gain and phase margin. Basic concepts of compensator design. State variable matrix and its use in system modelling and design. Sampled data system and performance of such a system with the samples in the error channel. Stability of sampled data system. Elements of non-linear control analysis. Control system components, electromechanical, hydraulic, pneumatic components.

## **PAPER IV Electrical Engineering**

### **1. Electrical Machines and Power Transformers**

Magnetic Circuits - Analysis and Design of Power transformers. Construction and testing. Equivalent circuits. Losses and efficiency. Regulation. Auto-transformer, 3-phase transformer. Parallel operation.

Basic concepts in rotating machines. EMF, torque, basic machine types. Construction and operation, leakage losses and efficiency.

B.C. Machines. Construction, Excitation methods. Circuit models. Armature reaction and commutation. Characteristics and performance analysis. Generators and motors. Starting and speed control. Testing, Losses and efficiency.

Synchronous Machines. Construction. Circuit model. Operating characteristics and performance analysis. Synchronous reactance. Efficiency. Voltage regulation. Salient-pole machine, Parallel operation. Hunting. Short circuit transients.

Induction Machines. Construction. Principle of operation. Rotating fields. Characteristics

and performance analysis. Determination of circuit model. Circle diagram. Starting and speed control.

Fractional KW motors. Single-phase synchronous and induction motors.

## **2. Power systems**

Types of Power Stations, Hydro, Thermal and Nuclear Stations. Pumped storage plants. Economics and operating factors.

Power transmission lines. Modeling and performance characteristics. Voltage control. Load flow studies. Optimal power system operation. Load frequency control. Symmetrical short circuit analysis. ZBus formulation. Symmetrical Components. Per Unit representation. Fault analysis. Transient and steady-state stability of power systems. Equal area criterion.

Power system Transients. Power system Protection Circuit breakers. Relays. HVDC transmission.

## **3. ANALOG AND DIGITAL ELECTRONICS AND CIRCUITS**

Semiconductor device physics, PN junctions and transistors, circuit models and parameters, FET, Zener, tunnel, Schottky, photo diodes and their applications, rectifier circuits, voltage regulators and multipliers, switching behavior of diodes and transistors.

Small signal amplifiers, biasing circuits, frequency response and improvement, multistage amplifiers and feed-back amplifiers, D.C. amplifiers, Oscillators. Large signal amplifiers, coupling methods, push pull amplifiers, operational amplifiers, wave shaping circuits. Multivibrators and flip-flops and their applications. Digital logic gate families, universal gates-combination circuits for arithmetic and logic operational, sequential logic circuits. Counters, registers, RAM and ROMs.

## **4. MICROPROCESSORS**

Microprocessor architecture-Instruction set and simple assembly language programming. Interfacing for memory and I/O. Applications of Micro-processors in power system.

## **5. COMMUNICATION SYSTEMS**

Types of modulation; AM, FM and PM. Demodulators. Noise and bandwidth considerations. Digital communication systems. Pulse code modulation and demodulation. Elements of sound and vision broadcasting. Carrier communication. Frequency division and time division multiplexing, Telemetry system in power engineering.

## **6. POWER ELECTRONICS**

Power Semiconductor devices. Thyristor. Power transistor, GTOs and MOSFETS. Characteristics and operation. AC to DC Converters; 1-phase and 3-phase DC to DC Converters; AC regulators. Thyristor controlled reactors; switched capacitor networks.

Inverters; single-phase and 3-phase. Pulse width modulation. Sinusoidal modulation with uniform sampling. Switched mode power supplies.

## **VIVA - VOCE**

The test is intended to judge the mental caliber of candidate. In broad terms this is really an assessment of not only his intellectual qualities but also social traits and his interest in current affairs, mental alertness, critical powers of assimilation, care and logical exposition, balance of judgment, variety and depth of interest.

**APPENDIX – II**

**CONDITIONS OF ELIGIBILITY FOR APPEARING IN THE EXAMINATION.**

In order to be eligible to appear in the Competitive Examination, a candidate must satisfy the following conditions, namely:-

(a) Minimum Educational Qualification	Degree in Electrical Engineering from a recognized University with three years of field experience in Engineering discipline under Central/State Government or under any registered Organisation/Company.
(b) Age	Should have attained the age of 21-30 years. (In case of Govt. servant, not more than 40 years).  The maximum age limit is relaxable by five (5) years in the case of SC/ST/BL candidates and four (4) and three (3) years for MBC/OBC candidates, respectively.
(c) Other Requisites	(1) Preference will be given to Sikkim Government stipendiaries/ seat reserved for State of Sikkim. (2) Should be conversant with the Custom and usages of Sikkim. (3) Should have knowledge of any of the State languages. (4) Should have valid Local Employment Card.

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