ELECTRICITY AND ELECTRONICS (866)

The syllabus is not intended to be used as a teaching syllabus, or to suggest teaching order. It is expected that teachers will wish to develop the subject in their own way.

In the examination, questions will be aimed more at testing the candidates' understanding of fundamental principles, and the application of these principles to problem situations, than to their ability to remember a large number of facts. Some questions will include simple calculations.

An experimental approach to the subject is envisaged and it is assumed that candidates will spend adequate time on individual experimental work. Questions may be set requiring descriptions of experimental procedures. Candidates should also know how to exhibit the results of experiments graphically and how to make deductions from graphs, e.g. from intercepts and gradient in the case of straight-line graphs, deductions by interpolation.

Candidates will be expected to be conversant with SI units.

CLASS XI

There will be two papers in the subject:

Paper I - *Theory: 3 hours…… 80 Marks*

Paper II - *Project Work ……. 20 Marks*

PAPER I (THEORY): 80 Marks

The paper will be divided into two parts.

Part I*: will consist of short answer questions. This part will be compulsory.*

Part II*: will consist of* ***eight*** *questions. Candidates will be required to answer* ***five*** *questions.*

1. Introduction to electricity. Structure of atoms; the model atom, nucleus, electrons. Unit of charge; coulomb. Potential difference and electromotive force. Production of electricity by friction, magnetism and chemical action.
2. Electric circuit. Electric current I = Qt. Ampere as rate of flow of charge. Ohm's law as applied to a single resistance (V/I=R) and to a whole circuit (E/I= total R).
3. Equivalence. Cell groupings. Resistances in series and parallel. Resistivity; R = Pl/A. Calculation of resistance of wire. Temperature coefficient of resistance. Ammeter shunts; voltmeter multipliers; series ohmmeter.
4. Work, power and energy. Work and energy. The joule. E =V/t (QV). Unit of power and energy; the watt, the kilowatt, the watt-hour and kilowatt-hour. Use of wattmeter. Calculation of electrical energy and power. Local tariff system.
5. Heating effect of an electric current. Application of heating effect, e.g. heating appliances, filament lamps, electric welding, electric carbon arc, and use of fuses.
6. Chemical effect of an electric current. Electrolytes and non-electrolytes. Elementary phenomena of electrolysis, including the electrolysis of acidified water, and of copper (II) sulphate solution using copper or platinum electrodes. The factors affecting the mass of substance liberated in electrolysis and the measurement of current by voltameter (coulometer). Primary cells; Leclanche cell; polarization; local action. Accumulators; construction and characteristics of lead-acid cell; techniques of testing and charging batteries; care and maintenance.
7. Electromagnetism. Simple phenomenon of magnetism. Ferromagnetic properties of iron and steel. Magnetic effect of an electric current. The magnetic field associated with a current flowing in a straight wire, a circular coil, and a solenoid. Force on a current-carrying conductor in a magnetic field; the right-hand and corkscrew rules. Magnetic flux density. Permeability.
8. Electromagnetic induction. Phenomenon of electromagnetic induction. Faraday's law; Lenz's law. Induced e.m.f.; a straight conductor cutting flux; $E = - d\varphi/dt = Blv$. Self-inductance; $E = - Ldi/dr$. Mutual inductance; the induction coil.
9. Elementary electrostatics. Electric field; E = V/d. Capacitance and the factors affecting capacitance. Electric flux density; D = Q/A. Permittivity; m = D/E. Energy of charged capacitors in series and in parallel.

10. Alternating current. Generation of an a.c. with a single loop coil. Sinusoidal wave form. Peak values; r.m.s. values (Only ratios will be expected.) Simple a.c. circuits.
11. Transformer. Principle of the single-phase transformer, and iron loss (hysteresis and eddy current).
12. Lighting. Common types of lamps; candela, lumen, lux, lux meter (light-meter). Illumination and photometry. Gas-filled lamps and fluorescent lamp circuits; preheat, instant and rapid starts.

PAPER II (PROJECT WORK): 20 Marks

In addition to the syllabus prescribed above, candidates are also required to be assessed in Project Work. All candidates will be required to have completed **two projects** from any topic/s covered in theory.

The Project work will be assessed by the subject teacher.

Mark allocation for *each* project (10 marks):

Criteria		Marks
1.	Title of the Project and Introduction	1
2.	Content	3
3.	Presentation and originality	2
4.	Conclusion/Comments/Summary	1
5.	Viva- Voce	3
TOTAL		**10**

List of suggested assignments for Project Work:

1. Use the given apparatus and material viz. resistor, ammeter (0-1.5 A), voltmeter (0-5 V), rheostat, battery, one-way key, sand paper and connecting wires and do the following:

   (i) Assemble an electrical circuit and draw the same.

   (ii) Modify the circuit using two resistors which may be connected in (a) series and (b) in parallel. Draw the same and explain the effect in each case.

   Does the current drawn from the cell remain constant? Discuss.

   (iii) How is an ammeter and a voltmeter connected in an electrical circuit? Give reason for your answer.

2. You are given the following items: rheostat, different kinds of keys, different types of resistances (carbon resistor, wire wound resistance box), different battery eliminators, dc sources (cells, batteries). Prepare a report covering the following:

   (i) Drawing a circuit diagram using rheostat as a potential divider and connecting the same to determine the voltage range provided.

   (ii) Identifying the functions of given keys in the electric circuit and drawing diagrams of each key.

   (iii) Explaining the different types of resistances given.

   (iv) Comparing the connecting wires used in household circuits and those used in the laboratory.

   (v) Differentiating between battery eliminators and dc sources (cells, batteries) and explaining how these are different from car batteries.

3. Assemble a household circuit comprising three bulbs (25W, 40W, 60W, 220V each), three (on/off) switches, a socket, a fuse (1.0 A), flexible connecting wire, main switch and a power source. Calculate the maximum current drawn for three bulbs used in the circuit.

   Draw a circuit diagram consisting of one tube light point, one staircase point using two-way switch, one fan point and one washing machine point.

4. Conduct an extensive study on any Indian /foreign Physicist. Prepare a report discussing their contributions.