

DEPARTMENT OF COMMUNICATIONSRADIOCOMMUNICATION OPERATOR'S GENERAL CERTIFICATE OF PROFICIENCYBROADCAST STATION OPERATOR'S CERTIFICATE OF PROFICIENCYSECTION E (ELECTRICAL THEORY)

JUNE 1983

(TIME ALLOWED - TWO HOURS)

NOTE SIX QUESTIONS ONLY to be attempted. Credit will not be given for more than SIX ANSWERS. All questions carry equal marks.

1. (a) Draw the phasor (vector) diagram of a balanced three-phase star-connected power system.
(b) With the aid of a circuit diagram, show how two wattmeters can be connected to read the total power in a three-phase, three-wire system.
2. (a) With the aid of diagrams, explain the theory of operation of a direct current shunt wound motor. Show the relationship between the direction of current flow in the armature, the magnetic field and the rotation of the armature.
(b) Briefly discuss the various losses associated with this type of machine.
3. (a) In relation to a power transformer, explain briefly what would happen if:
 - (i) mains supply frequency is lowered
 - (ii) primary voltage is exceeded by 50%
 - (iii) secondary winding is short-circuited
(b) List and discuss the losses which affect the efficiency of a power transformer.
4. With the aid of a circuit diagram, describe the operation of a multiple range transistor voltmeter.
5. (a) With the aid of a circuit diagram, explain the operation of a switch-mode power supply providing 250 volts DC output from a 12 volt DC source.
(b) Briefly explain the approximate operating efficiency of the power supply described in (a) when it is:
 - (i) lightly loaded
 - (ii) at the heaviest load for which the supply is designed
 - (iii) heavily overloaded

6. (a) Explain, with the aid of a sketch, how a typical hysteresis loop is obtained and say what information the loop conveys.
- (b) What method is used to reduce eddy-current losses in an iron-core transformer?
- (c) On what factors does the reluctance of a magnetic path depend?
7. (a) Assisted by diagrams explain the theory of operation of a Silicon Controlled Rectifier (SCR). (Characteristic graph to be shown).
- (b) A HF receiver experiences RF interference which is conveyed to the receiver via the mains supply. Describe how the interference could be minimised.
8. If the total power dissipated in the circuit below is 1100 Watts, calculate:
- (i) power in each resistor
- (ii) total circuit current

