Total number of printed pages – 6   **B. Tech**

CPEE 5361

Sixth Semester Examination – 2008

ELECTRICAL EQUPMENTS IN MINES

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory
and any **five** from the rest.
The figures in the right-hand margin
indicate marks.*

1. Answer the following questions :   2 ×10

   (a) Mention with reason the type of DC motor that is used for a load having approximately constant speed characterisitc.

   (b) Why a reduced voltage is applied while performing 'Short-Circuit Test' on a single-phase transformer ?

   (c) Draw the typical volt-ampere characterisits of a thyristor and show therein its 'holding current' and 'latching current'.

   (d) Mention with reason the type of three-phase induction motor used for loads requiring high starting torque.

   (e) Define the term 'slip' in case of an induction motor. What will be the rotor speed of a 3-phase, 8-poles, 50 Hz induction motor running with 3 % slip ?

   (f) Write down the expression for average DC voltage in case of a full wave single phase full controlled bridge rectifier using thyristors with firing angle 'alpha'.

   (g) What is 'two-part tariff' ? Explain briefly with an example.

(h) Why an 'intrinsically safe' apparatus is used in mining area ? How is this different from an ordinary apparatus used in non-hazardous area ?

(i) Explain what you mean by 'sequence control' of open cast mining equipment.

(j) Draw the block diagram showing the 'signaling system' adopted in mining environment.

2. (a) Describe, with neat sketch, the transverse cross section of a typical three and half core three phase cable used in mines. 5

(b) Explain the rectification method of obtaining a controlled DC supply from a single-phase AC supply. Draw the relevant waveforms with a firing angle 'alpha'– 30 degree. 5

3. (a) Draw and explain the speed-torque characteristic of a DC series motor. 5

(b) Explain the method of charging the batteries used as a back-up to the 'control supply' needed for the switchgears. 5

4. (a) State the differences between 'two-part tariff' and 'flat-rate tariff'. Give one example in each case. 5

(b) Explain how the speed of a three-phase induction motor can be changed by changing the supply voltage. Discuss the demerits, if any, of this method. 5

5. (a) How can the speed of a DC shunt motor be controlled by varying its field current ? Discuss the merits and demerits of this method. 4

(b) The speed of a 400 V DC shunt motor driving a 10 kW load is to be increased by 20 % by placing a resistor 'R' in the field circuit. The field resistance is 200 ohms and the armature resistance is 0.5 ohm. Determine the value of the resistor 'R' in ohms. Assume that the motor operates at 'constant power' and has an efficiency of 85 %. Neglect saturation effects.   6

6. Explain the Ward-Leonard method of speed control used in colliery winders requiring whole range speed control – from zero to full speed. What are the demerits of this method ? Explain in brief.   10

7. (a) Explain in brief the different sensors used for measurement of various operational, environmental and safety parameters in underground mines.   5

(b) Explain how the demerits of an open loop control system be nullified with the help of a closed loop control system.   5

8. Write short notes on :   5+5

(a) Underground Transducers in mines

(b) Gate-end boxes used in mines.

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