

Department of Electrical Engineering, I.I.T. Delhi
EEL332 Electrical Drives system
Minor test-1

Max marks: 20

Date and Time: 31/1/2017 11:00 to 12:00 Hrs

Venue: LH 308

If you make any assumptions, please put them down on the answer script.

A. State TRUE or FALSE and justify your answer.

(5 X 2 =10 Marks)

1. Current Limit Control can be used very effectively for starting a DC motor drive with a controlled rectifier in its armature.
2. A current transformer is very good for sensing AC and DC currents and always depicts a linear relationship between its output and input currents.
3. A DC series motor will work very efficiently with AC as well as DC supply voltages.
4. A hoist which lifts up varying weights during one complete cycle of operation can use flywheel effectively, to reduce the rating of the motor to be utilized.
5. A level compounded DC motor (whose speed is almost a constant irrespective of the torque developed) has to be a cumulatively compounded DC motor only.

B. (i) Derive the expression to calculate the short-term duty rating of an electric motor whose rating is P_r Watts, the heating time constant (in minutes) is τ_h . The machine has a ratio of constant losses to copper losses as ' α '. Assume that the machine is at a higher load (heating) for the duration of H minutes and the rest period good enough cool the machine back to the ambient temperature. (2.5 MARKS)

(ii) The heating and cooling time constants of a 120 kW motor are 90 and 120 minutes respectively. Find the quarter-hour rating of the motor. The maximum efficiency of 90% occurs at 75% of the rated load. (2.5 MARKS)

C. A 15 kW, 230 V DC shunt motor has a total armature resistance inclusive of the brush contact resistance of 0.24Ω and field resistance of 115Ω with its rated efficiency being 90.58%. At no-load and rated voltage the speed is 1200 rpm and the line current is 5 A. At rated voltage and at certain load with the field resistance increased to 150Ω , the motor draws rated line current. Calculate the motor speed assuming that the flux/pole to be reduced by 5% at this new value of field current. Calculate the different losses in the machine and the efficiency at this condition. (5 MARKS)