

# Government College of Engineering, Aurangabad

(An Autonomous Institute of Government of Maharashtra)

## B. E. (ELECTRICAL-ELECTRONICS AND POWER) FT Examination

End Semester Examination November 2016

EE 443 – ELECTRICAL DRIVES

18.NOV 2016

Time: Three Hours

Max. Marks: 60

“Verify the course code and check whether you got the correct question paper”

N. B.

1. Solve any four questions
2. Each question carry 15 Marks and sub-question carries (9+6) Marks
2. Assume suitable data if necessary and state it clearly
3. Use of non-programmable calculator is allowed

- Q.1. a) What are speed-torque conventions of electrical drives? Discuss multi-quadrant operation with the help of suitable example. (9M)
- b) A motor drives four loads, two have rotational motions and two translational motions. Moment of inertia of the motor is  $1.2 \text{ kg-m}^2$ . Motor runs at a speed of 1000 rpm. Following are the details about four loads:

Load	Type of motion	Speed	Inertia/Mass	Torque/Force
I	Rotational	200 rpm	$7 \text{ kg-m}^2$	10 N-m
II	Rotational	200 rpm	$5 \text{ kg-m}^2$	6 N-m
III	Translational	10M/S	10 kg	20 N
IV	Translational	10M/S	20 kg	30 N

Calculate the equivalent inertia of the system referred to the motor shaft and power rating of the motor, assuming negligible loss in the transmission system. (6M)

- Q.2. a) What are the braking methods of DC motor? Discuss with the help of curves. (9M)
- b) Half hour rating of a motor is 100 kW. Heating time constant is 80 min and the maximum efficiency occurs at 70% full load. Determine the continuous rating of the motor. (6M)
- Q.3. a) Discuss in detail 1-phase fully controlled rectifier control of dc separately excited motor. Draw suitable waveforms and speed-torque characteristics. (9M)
- b) A 220 V, 200A, 750 rpm separately excited motor has an armature resistance of  $0.05 \Omega$ . It is driving a load whose torque has an expression  $T_1 = 500 - 0.25N$ , N-m, where N is the speed in rpm. Speeds below rated are obtained by armature voltage control (with full field) and speeds above rated are obtained by field control (with rated armature voltage).

Calculate

- i) Motor terminal voltage and armature current when the speed is 400 rpm.
- ii) Value of flux as a percentage of rated flux when the speed is 1500 rpm. (6M)

Q.4. a) A 400 V, star connected, 3-phase, 6-pole, 50 Hz induction motor has following parameters referred to the stator:  $R_s = R_r' = 1 \Omega$ ,  $X_s = X_r' = 2 \Omega$ .

For regenerative braking operation of this motor determine:

- i) Maximum overhauling torque it can hold and range of speed for safe operation.
  - ii) Speed at which it will hold an overhauling load with a torque of 100 N-m.
  - iii) Maximum overhauling torque the motor can hold as a ratio of maximum overhauling torque without capacitor if a capacitive reactance of  $2 \Omega$  is inserted in each phase of stator. (9M)
- b) Discuss the operation of induction motor with unbalanced source voltages and single phasing with the help of curves. (6M)

Q.5 a) What is slip power recovery of an induction motor? Discuss in detail with the schematic diagram. (9M)

- b) A 220V, 800 rpm, 80 A separately excited motor has the armature resistance of  $0.12 \Omega$ . Motor is driving under the rated conditions, a load whose torque is constant at all speeds. Calculate motor speed if the source voltage drops to 200 V. (6M)

Q.6. a) What are important features of Traction Drives? Discuss motors employed in traction and different drives used in it. (9M)

- b) Mention various applications of Solar and Battery powered drives? Discuss any one in detail. (6M)
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