UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program/course: M.Tech Rotating Equipment **Semester – I**
Subject: Electric Motor & Drives **Max. Marks : 100**
Code   :EPEC 7008 **Duration : 3 Hrs**
No. of page/s:2

SECTION A (20 MARKS)

Attempt all questions. Each question carries 4 marks.

Q1- [CO1] State essential parts of electric drives. What are the functions of a power modulator?

Q2- [CO1] Devise multi quadrant operation of electric car.

Q3- [CO1] Define components of load torque.

Q4- [CO2] Brief about constant power drives.

Q5- [CO5] Deduce the working of universal motor.

SECTION B (40 MARKS)

Attempt all questions. Each question carries 10 marks.

Q6- [CO3, CO4] A Crane is used to carry weight in the industry. This Crane uses dc separately excited motor of 220 V, 200 A, 800 rpm. This motor has an armature resistance of 0.06 Ω. The motor armature is fed from a variable voltage source with an internal resistance of   0.04 Ω. Calculate internal voltage of the variable voltage source when the motor is operating in regenerative braking at 80% of the rated motor torque and 600 rpm.

Q7- [CO3, CO4] An elevator uses 220 V, 970 rpm, 100 A, dc separately excited motor to lift a weight up to 600 kg. The armature resistance of motor is 0.05 Ω. This motor is braked by plugging from an initial speed of 1000 rpm. Calculate (a) resistance to be placed in armature circuit to limit braking current to twice the full load value, (b) braking torque, and (c) torque when the speed fallen to zero.

Q8- [CO2, CO4] "An induction motor can be used as an induction generator". Justify the statement by deriving torque-slip relationship for poly-phase induction motor. Also discuss different operating regions of the induction motor by its torque-slip characteristics.

Q9- [CO2, CO4] Explain self-controlled synchronous motor drive employing load commutated thyristor inverter.

SECTION C (40 MARKS)

Attempt both questions. Each question carries 20 marks.

Q10- [CO2, CO3, CO4] An industrial fan type load is driven by a three phase squirrel cage induction motor. Show that rotor current is maximum when motor runs at a slip s=1/3. Find also an expression for maximum rotor current. Also determine the maximum current in terms of rated current for the motor running at (1) 1455 rpm (2) 1350 rpm. No load rotational losses are negligible

OR

Explain slip energy recovery scheme in case of poly-phase induction motor. Also discuss sub-synchronous (Static Kramer Drive) and super-synchronous drives (Static Sherbius Drive).

Q11- [CO3, CO4] A centrifugal pump uses a 500 kw, 3 phase, 1.1 KV, 50 Hz, 0.8 (lagging) power factor, 4 pole, star connected synchronous motor. This motor has following parameters: X_s = 15 Ω, R_s = 0. Rated field current is 10 A. Determine

a- Armature current and power factor at half the rated torque and rated field current.
b- Field current to get unity power factor at the rated torque.
c- Torque for unity power factor operation at field current of 15 A.

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SECTION A (20 MARKS)

Attempt all questions. Each question carries 4 marks.

Q1- [CO1] Compare electric drives with mechanical drives.

Q2- [CO1] Explain torque speed conventions in case of electric drives.

Q3- [CO1] Derive fundamental torque equation in case of drives.

Q4- [CO1] Brief about constant torque drives.

Q5- [CO2] Deduce the working of dc servo motor.

SECTION B (40 MARKS)

Attempt all questions. Each question carries 10 marks.

Q6- [CO3, CO4] An electric car uses a 110 V, 50 A, 1000 rpm dc separately excited motor has an armature resistance of 0.08 Ω. The motor armature is fed from a variable voltage source with an internal resistance of 0.06 Ω. Calculate internal voltage of the variable voltage source when the motor is operating in regenerative braking at 60% of the rated motor torque and 600 rpm.

Q7- [CO3, CO4] A 110 V, 870 rpm, 50 A, dc separately excited motor has an armature resistance of 0.05 Ω. It is braked by plugging from an initial speed of 1000 rpm. Calculate (a) resistance to be placed in armature circuit to limit braking current to twice the full load value, (b) braking torque, and (c) torque when the speed fallen to zero.

Q8- [CO2, CO4]A current source inverter is used to control the speed of poly-phase induction motor. Derive the torque-speed relationship in this case.

Q9- [CO2,CO4] Explain the equivalent circuit of cylindrical rotor wound field motor. Also derive the equation for torque..

SECTION C (40 MARKS)

Attempt both questions. Each question carries 20 marks.

Q10- [CO3, CO4] A three phase squirrel cage induction motor drives a blower type load. No load rotational losses are negligible. Show that rotor current is maximum when motor runs at a slip s=1/3. Find also an expression for maximum rotor current. Also determine the maximum current in terms of rated current for the motor running at (1) 1465 rpm (2) 1360 rpm.

OR

Explain stator voltage control method for speed control of polyphaser induction motor. Determine the speed of motor if the ratio of maximum rotor current and rated rotor current is (a) 3 (b) 2. No-load rotational losses are negligible.

Q11- [CO3, CO4] A 300 kw, 3 phase, 3.3KV, 50 Hz, 0.8 (lagging) power factor, 4 pole, star connected synchronous motor has following parameters: $X_s = 30\ \Omega$, $R_s = 0$. Rated field current is 20 A. Calculate

a- Armature current and power factor at half the rated torque and rated field current.
b- Field current to get unity power factor at the rated torque.
c- Torque for unity power factor operation at field current of 12.5 A.