

BAE 507 Electro-mechanical Energy conversion

Test

Total = 100 marks

Each 10 marks

① The elementary rotating machine is coupled to a mechanical device which can be made to absorb or develop mechanical torque over a wide range of speeds. Winding is excited with direct current I_r and stator winding is connected to ac source.

Stator current is $i_s = I_s \cos \omega_s t$

(a) Derive the expression for magnetic torque developed by the machine

(b) If machine is 2 poles and frequency is 50 Hz calculate the speed

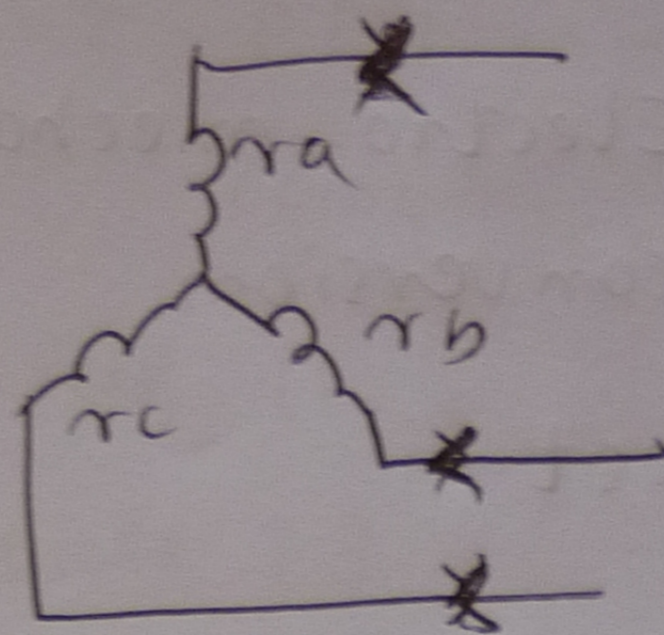
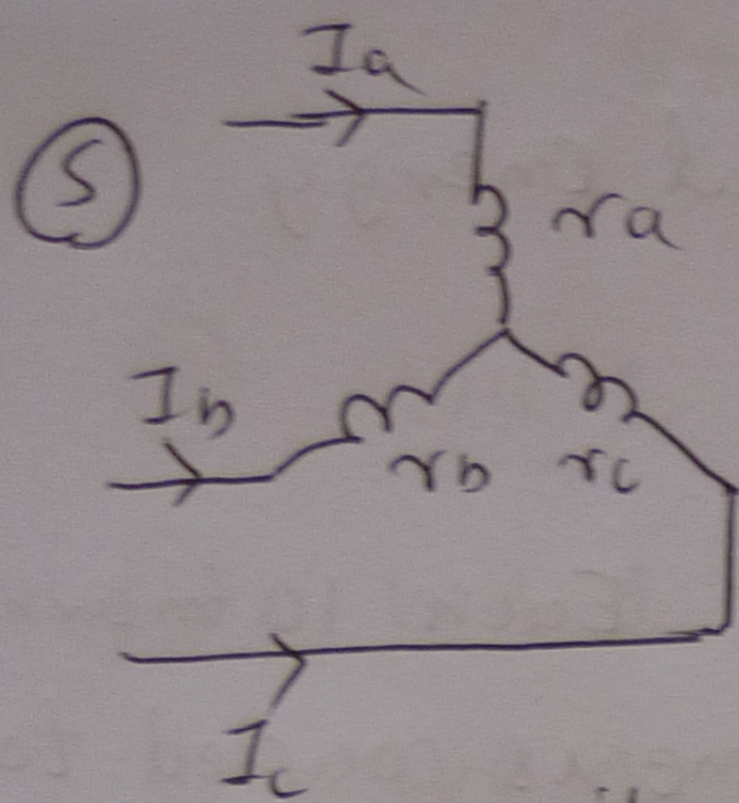
② Sketch & explain turbo generator excitation system

③ A 3 ϕ , 6 pole ac machine has full pitch winding distributed in 36 slots. Determine the winding factor k_w

④ A 200 HP, 2300 V, 3 ϕ 50 Hz, 28 pole, 211 RPM motor is connected to large power system. $W_k^2 = 10500 \text{ lb-ft}$, $P_s = 110 \text{ kW}$

Damping Torque = 1770 lb-ft

Find electrodynamic oscillation.



Rotor

Write equations for
 (a) voltage-current relationship.
 (b) voltage & flux equations

(6) A 3 ϕ λ 220V (L-L) 10HP, 50Hz, 6 pole induction motor has the following constants in ohms/phase

$$r_1 = 0.294, \quad r_2 = 0.144, \quad X_1 = 0.501, \quad X_2 = 0.209$$

$$X_\phi = 13.25$$

Total frictions, windage, core losses are 403 watt.

Slip = 2%, compute speed, output torque, power factor & efficiency

(7) Write symmetrical components for 2 phase machine.

(8) Explain elementary motor speed regulator.

(9) Write the equations for single phase rectifier with resistance load

(10) Sketch 4-quadrant chopper circuit.