

## GANPAT UNIVERSITY

B. Tech. Semester III<sup>rd</sup> Biomedical and Instrumentation Engineering

Regular Examination November – December 2013

2BM302 - MEDICAL SYSTEM ACTUATORS &amp; ELECTRICAL MACHINES

Time: 3 Hours / As per Scheme

Total Marks: 70

## Instruction:

1. Answer to the questions must be written in separate answer books.
2. Figure to the right indicate marks.
3. Conventional terms / notations are used.
4. All the questions are compulsory

## Section - I

Que. - 1

- a) A 10 KW shunt generator having an armature circuit resistance of  $0.75 \Omega$  and a field resistance of  $125 \Omega$ , generates a terminal voltage of 250 V at full load. Determine the efficiency of the generator at full load, assuming the iron, friction and windage losses amount to 600 W. 6
- b) What are the major specifications of a magnetostrictive actuator? What are the major specifications of magnetostrictive actuator geometry? 6

OR

Que. - 1

- a) A series motor has an armature resistance of ( $0.2 \Omega$ ) and a series field resistance of ( $0.3 \Omega$ ). It is connected to a (240 V) supply and at a particular load runs at (1440 r.p.m) when drawing (15 A) from the supply. 6
- (a) Determine the back e.m.f at this load.
- (b) Calculate the speed of motor when the load is changed such that the current is increased to (30 A). Assume that this causes a doubling of flux.
- b) Write short note on AC two phase Servomotor. 6

Que. - 2

- a) Explain the voltage build up in dc generator 6
- b) Explain the factors determining speed of DC motors. 5

OR

Que. - 2

- a) A 230V DC shunt motor takes an armature current of 20A on a particular load .The armature circuit resistance is  $0.5 \Omega$ . Find the resistance required in series with the armature to reduce the speed by 50%.if a) the load torque is constant and b) the load torque is proportional to the square of the speed. 6
- b) Write short note on stepper motor. 5



Que. - 3

- a) The armature supply voltage of a DC motor is 230 V, the armature current is 12A, the armature resistance is 0.8 ohm and the speed is 100 rad/sec. Calculate (a) the induced emf b) the electromagnetic torque c) the electrical power input to the armature d) the mechanical power developed by the armature e) the armature copper loss. 6
- b) A 220V .dc series motor has a resistance of 0.2  $\Omega$ . When the current is 40 A, speed is 1800 rpm .Find the resistance to be added in series with motor .a) to limit the speed to 3600 rpm when line current is 10 A [Assume that between line current of 10A and 40A, flux is proportional to current]; b) to make motor run at 900 rpm when line current is 60A [Assume that flux at 60A is 1.18 times the flux at 40A]; c) Find the speed of motor when it is connected directly to mains and line current I 60 A. 6

### Section - II

Que. - 4

- a) Define Transformer. Explain principle of operation of transformer. 6
- b) A single phase transformer has turns ratio  $N_2:N_1 = 1:4$ . The values of the primary and secondary resistance are 0.25 ohm and 0.01 ohm respectively. The values of primary and secondary reactance are 0.01ohm and 0.04 ohm respectively. Calculate (i) the equivalent resistance and reactance referred to primary (ii) the equivalent impedance referred to primary (iii) the phase angle of the impedance. 6

OR

Que. - 4

- a) Write a short note on Auto transformer. 6
- b) Name special types of transformer. Explain any one of it. 6

Que. - 5

- a) Draw and explain construction of three phase induction motor. 6
- b) A 6 pole, 3 phase, 50 Hz induction motor runs at 925 rpm. Calculate (i) slip speed 5  
(ii) percentage slip (iii) frequency of rotor current.

OR

Que. - 5

- a) Name the types of single phase induction motor. Explain any one of it. 6
- b) A 4 pole induction motor operates on 440V, 50 Hz supply. Its rotor current make 84 complete cycles in one minute, when the shaft torque is 203.5N-m. Calculate the motor output power. 5

Que. - 6

- a) Write application of single phase and three phase induction motor. 2
- b) Give difference between induction machines and synchronous machines. 2
- c) Define: regulation of transformer, efficiency of a transformer. 2
- d) Explain On load condition of a transformer. 3
- e) A 150W, 12 V lamp is connected to a secondary of a transformer. The primary is supplied from 240 V mains. Calculate the turns ratio and the current drawn from the supply. 3

END OF PAPER