GANPAT UNIVERSITY
B.TECH. SEMESTER –III BIOMEDICAL & INSTRUMENTATION ENGINEERING
REGULAR EXAMINATION NOV – DEC 2011.
2BM 302: MEDICAL SYSTEM ACTUATORS AND ELECTRICAL MACHINES

Time:- 3 Hours   Total Marks:- 70

Instructions:
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   12
- A. Define Solenoid. Draw & Explain the experimental set up of Hydraulic solenoid valve with neat figure.
- B. What do you understand by medical actuator? Draw the basic hydraulic system with rotary hydraulic actuator & explain in detail.
- C. What is Relay? Explain any one of the basic classification of relays with its application.

OR

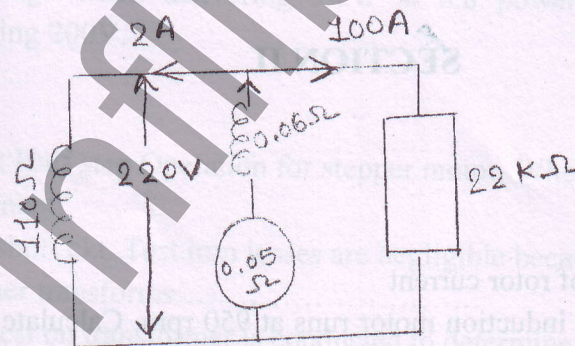**Que.1**   12
- A. How does a Hydraulic actuator work? Draw the basic hydraulic system with linear hydraulic actuator?
- B. Explain working principle of Analog & Digital tachometer for Servomotor with neat figure.
- C. What do you understand by Piezoelectric actuator? Explain its application in detail.

Que.2   11

A.

A long shunt generator running at 1000 r.p.m. Supplies 22KW. The overall efficiency is 88%. Determine i) e.m.f. generated by armature ii) cu losses iii) iron losses iv) the torque.
- B. A 25KW, 250V dc shunt generator has armature & field resistances of 0.065Ω and 110Ω respectively. Determine the total armature power developed when working i) as a generator delivering 25KW o/p. ii) as a motor taking 25 KW i/p.
- C. Derive e.m.f. equation of a generator and also derive condition for maximum efficiency of a generator.

OR

Que.2

A. The input to 220V dc shunt motor is 11KW with efficiency 79.6%.Calculate
i) friction losses ii) the speed at this level iii) the torque developed at this load
Where, Ra=0.5Ω, no load current=5A, no load speed=1150 r.p.m.

B. A 250V, 4 pole, wave wound dc series motor has 782 conductors on its armature. It has armature and series field resistance of 0.75Ω & 110Ω. The motor takes a current of 40A. Estimate its speed and gross torque developed. If it has a flux per pole of 25mwb.

C. Write the principle of d.c. motor & show the comparison between d.c. Generator & d.c . Motor with neat figure.

Que.3

A. What is the difference between Pneumatic & Hydraulic actuator? Draw & explain the pneumatic system with linear pneumatic actuator.

B. Explain general concept for servo motor with neat block diagram.

C. Answer the following in one sentence:
1. If you have given, the motor has back e.m.f. 474V & Φ=0.05wb, then find speed?
2. A D.C. motor works on the principle that when…………………….
3. The e.m.f. induced in the armature of a shunt generator is 600V. The armature resistance is 0.1Ω., if the armature current is 200A, the terminal voltage will be……………………….
4. For a stepper motor, if 144 steps/revolution is there then find the step angle?

SECTION II

Que.4

A. Define: 1. Slip
2. Rotor e.m.f.
3. Rotor current
4. Frequency of rotor current

B. A 6-pole, 3-phase, 50Hz induction motor runs at 950 rpm. Calculate the slip speed, the percentage slip and the frequency of rotor current.

C. Write a short note on split phase capacitor start induction motor.

OR

Que.4

A. Explain the working principle and construction details of a three phase Induction Motor

B. Draw the equivalent circuit of an Induction motor & derive the condition for maximum power output. & A 3 phase alternator having 12 poles is driven at a speed of 500 r.p.m. It supplies power to 8-pole, 3 phase induction motor, if the slip of the motor at full load is 4%. Calculate the full load speed of the motor.

A. Explain working principle of Transformer & derive e.m.f. equation for it. & also calculate A 1-phase transformer has turns ratio $N_2 : N_1 = 1 : 4$, $R_1 = 0.25\Omega$, $R_2 = 0.01\Omega$, $X_1 = 1.0\Omega$, $X_2 = 0.01\Omega$. Calculate the equivalent resistance, reactance and impedance referred to the primary.

B. A 20 KVA , 2000/200V Transformer has an iron loss of 300W & full load copper loss of 400W. during the day it is loaded as follows:

No. of Hours	Load	Power factor
8	¼ load	0.5
6	Full load	0.8
6	¾ load	unity
4	no-load	-

OR

Que.5

11

A. Outline carefully the procedure for performing the short ckt. Test & what useful information is obtained from this test?
A 500 KVA transformer has iron loss of 2.5 KW and full load copper loss of 4 KW. Find: (1) The KVA output at which the efficiency is maximum.
(2) the maximum efficiency at load power factor of 0.85 lag

B. Determine the equivalent ckt. Of a 200/400 V , 50 Hz single phase transformer from the following test are:
O.C. test (l.v. side) : 200V, 0.7 A, 70W   S.c. test (h.v. side)   15V, 10 A, 85W
Calculate equivalent resistance & reactance referred to secondary & also calculate the secondary voltage when delivering 5KW at 0.8 power factor lagging, the primary voltage being 200V.

Que.6

A. Discuss Full step & Half step Operation for stepper motor. Where, Ns=8 & Nr=6.   06
B. Complete the statement: 03
1. During the short ckt. Test iron losses are negligible because.........................
2. A transformer transforms.............................
3. Open ckt. Test on transformer is conducted to determine.........................
C. Define the torque & power of an Induction motor & derive the condition for   03 maximum torque.

END OF PAPER