ELECTRICAL MACHINES AND UTILIZATION
DME 109 AND DME 110 P
MARCH/APRIL 2010 SERIES

THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

DEPARTMENT OF MEDICAL ENGINEERING

DIPLOMA IN MEDICAL ENGINEERING

END SEMESTER EXAMINATION

TIME: 2 HOURS

INSTRUCTIONS TO THE CANDIDATE.

- This paper contains FIVE questions.
- Attempt Question 1 and any other TWO questions
- Question 1 carries 30 marks. The other FOUR questions carry 20 marks each.

Q1(a). Define "grid system" (5 marks)

(b). Explain how electricity is generated in a thermal power station. (10 marks)

(c). Describe the THREE main parts of a d.c. motor. (6 marks)

(d). A 3-phase motor has a power-factor of 0.4 lagging. Two wattmeters connected to measure power show the input as 30KW. Calculate the reading on each wattmeter. (9 marks)

Q2(a). Define "transformer" (5 marks)

(b). With the aid of labeled diagrams, show three windings which are

(i) star connected
(ii) delta connected (6 marks)

(c). The input current to a 3-phase step-down transformer connected to an 11KV supply system is 14A. Calculate the secondary line voltage and current for star-star connection if the voltage transformation ratio is 44. (9 marks)

Q3(a). List any THREE factors to be considered during rewinding. (3 marks)

(b). Describe "single –phasing" and state how it can be detected in 3-phase motors. (5 marks)

(c). With the aid of labeled diagram, explain the principle of operation of a 3-phase induction motor. (12 marks)

Q4.(a). Explain why a single-phase a.c motor is not self-starting. (5 marks)

(b). Draw circuit diagrams to illustrate THREE methods of starting single-phase a.c. motors. (6 marks)

(c). A 4-pole, 250W, 115V, 60Hz capacitor-start induction motor takes a full-load current of 5.3A while running at 1760 r.p.m. If the full-load efficiency of the motor is 84%, calculate the:-

(i). motor slip
(ii). power-factor (9 marks)

Q5. (a). Describe the following:-

(i). group drives
(ii). individual drives. (4 marks)

(b). State

(i). THREE ways of cooling in 3-phase transformers.

(ii). ONE method used to very speed in 3-phase induction motors.

(iii). The effect of interchanging any two phase lines supplying a 3-phase induction motor.

(6 marks)

(c). A 3-phase induction motor is wound for 4 poles and is supplied from a 50Hz system.

Calculate:-

(i). the synchronous speed

(ii). the speed of the motor when the slip is 4%.

(10 marks)

Q1. (a). Define “electric shock”. (5 marks)

(b). Explain how electricity is generated in a hydro power station. (10 marks)

(c). Describe the following parts of a 3-phase induction motor:

(i). Stator
(ii). Rotor (6 marks)

(d). The two-wattmeter method is used to measure the power absorbed by a 3-phase induction motor. The wattmeter readings are 12.5KW and – 4.8KW. Calculate the total power

(i). the total power absorbed by the machine
(ii). the load power-factor. (9 marks)

Q2. (a). Describe the following

(i). group drives.
(ii). individual drives (4 marks)

(b). State

(i). THREE ways of cooling in 3-phase transformers.

(ii). ONE method used to vary speed in 3-phase induction motors.

(iii). The effect of interchanging any two phase lines supplying a 3-phase induction motor. (6 marks)

(c). A 3-phase induction motor is wound for 4 poles and is supplied from a 50Hz system. Calculate:-

(i). the synchronous speed

(ii). the speed of the motor when the slip is 4%. (10 marks)

Q3. (a). Explain why a single-phase a.c. motor is not self-starting. (5 marks)

(b). Draw circuit diagrams to illustrate THREE methods of starting single-phase a.c. motors. (6 marks)

(c). A 4-pole, 250W, 115V, 60Hz capacitor-start induction motor takes a full-load current of 5.3A while running at 1760 r.p.m. If the full-load efficiency of the motor is 64%, Calculate:

(i). the motor slip

(ii). the power factor

Q4. (a). List any THREE factors to be considered during rewinding. (3 marks)

(b). Describe "single-phasing" and state how it can be detected in 3-phase motors. (5 marks)

(c). With the aid of labeled diagram, explain the principle of operation of a 3-phase induction motor. (12 marks)

Q5. (a). State the main difference between induction motor and synchrous motor. (5 marks)

(b). Draw labeled diagrams to show three windings which are

(i). Star connected

(ii). Delta connected (6 marks)

(c). The input current to a 3 – phase step-down transformer connected to an 11Kv supply system is 14A. Calculate the secondary line voltage and current for star-star connection if the voltage transformation ratio is 44.

(9 marks)