



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

Faculty of Engineering and Technology

DEPARTMENT OF MEDICAL ENGINEERING

DIPLOMA IN MEDICAL ENGINEERING
DME 210 Y2 SI

EHL 2206: ELECTRICAL MACHINE & UTILIZATION

END OF SEMESTER EXAMINATIONS

SERIES: DECEMBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*

Answer question **ONE (COMPULSORY)** from **SECTION A** and any other **TWO** questions from **SECTION B**

Maximum marks for each part of a question are clearly shown

This paper consists of **THREE** printed pages

SECTION A (Compulsory)

Question 1

- a) Define communication as used in DC machine (2 marks)
- b) **THREE** identical coil, each of resistance $10\ \Omega$ and inductance 42mH are connected in star and in delta to a 415V, 50Hz, 3 phase supply. Determine the total power dissipated in each case (10 marks)
- c) Explain the principle of operation of a **THREE** phase induction motor (7 marks)
- d) State **TWO** types of universal motors (2 marks)
- e) State **THREE** application of repulsion type motor (3 marks)
- f) Explain any **TWO** losses in a three phase transformer (6 marks)

SECTION B (attempt any TWO questions)

Question 2

- a) Differentiate between positive and negative sequence in three phase systems (4 marks)
- b) Compare between star and delta connection of the three phase system (4 marks)
- c) A workshop is provided with a 440V 50Hz three phase four wire supply and feeds the following loads between each of the three separate phase and neutral
- (i) Four single phase induction motors each rated at 1Kw and with a lagging power factor of 0.8 connected to the red phase
 - (ii) A lighting load of 2Kw at unity power factor connected to the yellow phase
 - (iii) A heating load of 4Kw at unity power factor connected to the blue phase

Determine the current in each line and the neutral current. Assume that the phase voltage is 250V (10 marks)

- d) State any **TWO** advantages of **THREE** phase system over single phase supply (2 marks)

Question 3

- a) Distinguish between the function of a motor and a generator (4 marks)
- b) Explain the effects of armature reaction in motor and generator (6 marks)
- c) 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 240V supply and at a particular load runs at 24rev/s when drawing a 15A current from the supply; Determine :

- (i) The generated emf at this load (2 marks)
 - (ii) The speed of the motor when load is changed such that the current is increased to 30A. Assume that this causes a doubling of flux (6 marks)
- d) State the DC generators type as classified according to the method of their field excitation (2 marks)

Question 4

- a) State any **THREE** applications of **THREE** phase synchronous motor (3 marks)
 - b) Differentiate between synchronous machine and asynchronous machine (6 marks)
- c) A 3^ϕ, 16 pole synchronous machine has a star connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03wb speed of machine is 375r pm. Determine:
- (i) The frequency (1 mark)
 - (ii) The phase emf (8 marks)
 - (iii) The line emf (2 marks)

Take $K_p = 1$

Question 5

- a) State any **TWO** applications of a three phase induction motor (2 marks)
- b) With an aid of a polyphase waveform and mmf phasor diagram, show that the mmf of the the three phase induction stator rotates at 360°. (8 marks)
- c) A 3 phase, 60Hz induction motor has 2 poles. If the slip is 2 percent at a certain load, determine:
 - (i) The synchronous speed (2 marks)
 - (ii) The speed of the rotor (4 marks)
 - (iii) The frequency of the induced emf in the rotor (2 marks)
- d) State any **TWO** advantages of squirrel cage motor compared to wound rotor type induction motor (2 marks)