



# TECHNICAL UNIVERSITY OF MOMBASA

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**Faculty of Engineering and Technology in Conjunction with Kenya Institute of Highways  
& Building Technology (KIHBT)**

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

## UNIVERSITY EXAMINATION FOR 2017/2018:

HIGHER DIPLOMA IN TECHNOLOGY  
ELECTRICAL POWER ENGINEERING

**EEP 3202: ELECTRICAL MACHINES**

END OF SEMESTER EXAMINATION

**SERIES: DECEMBER 2017**

**TIME: 2 HOURS**

**DATE:** Pick DateSelect MonthPick Year

### **Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of **FIVE** Questions; each question carries 20 Marks. Attempt any **THREE** Questions.

**Do not write on the question paper.**

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### **Question ONE**

- a) With an aid of a diagram explain the speed control of a DC shunt motor using flux control method. **(6 marks)**
- b) State the advantages and disadvantages of the flux control method of speed control **(6 marks)**

- c) A 200KW, 500V, Variable motor is supplied by a 2500KW generator using Ward-Leonard System shown in **Figure Q1**. The total resistance of the motor and generator armature circuit is  $10\text{m}\Omega$ . The motor turns at nominal speed of 300rpm, when back e.m.f  $E_o = 600\text{V}$ . Calculate the motor torque and speed when  $E_s = 400\text{V}$  and  $E_o = 340\text{V}$ . **(8 marks)**

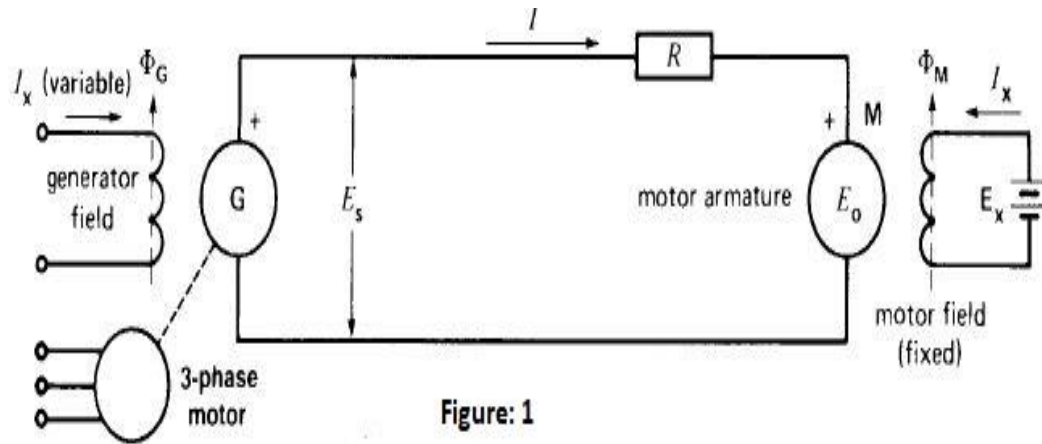


Figure: 1

Figure Q1

### Question TWO

- a) Explain why a starting resistor is needed to bring a motor up to speed **(1 mark)**
- b) A 10KW, 100V, 1000rpm DC Machine has a  $R_a = 0.1\Omega$  and is connected to a 100V DC supply. Determine:
- The starting current if no starting resistance is used in the armature circuit. **(3 marks)**
  - The value of the starting resistance if the starting current is limited to twice the rated current. **(2 marks)**
- c) Describe the difference between three-point and four-point starters **(4 marks)**
- d) A 220V shunt motor has an armature resistance of  $0.4\Omega$ . The armature current at starting must not exceed 40A. If the number of sections is 6, calculate the values of resistor steps to be used in this starter. **(10 marks)**

### Question THREE

- a) Briefly explain the following:

- i. Plugging
  - ii. Rheostatic Braking
  - iii. Regenerative Braking **(9 marks)**
- b) A 20h.p, 220V Shunt motor takes full – load current of 80A, speed 1000rpm, armature resistance  $0.1\Omega$ , shunt resistance  $110\Omega$ . It is to be braked by plugging. What resistance must be placed in series to limit the current to 110A? Find also the initial value of the braking torque. **(6 marks)**
- c) State main advantages of electric braking. **(3 marks)**
- d) Cite applications of dynamic braking. **(2 marks)**

#### **Question FOUR**

- a) i. Describe the Hopkinson’s Method of determining efficiency.  
 ii. Explain the advantages of Hopkinson’s test **(14 marks)**
- b) In a Hopkinson’s test on two 440V, 200KW generators, the circulating current is equal to the full load current, and in addition, 90A are taken from the supply. Find the efficiency of each machine. **(6 marks)**

#### **Question FIVE**

- a) List **FOUR** main types of single phase motors. **(4 marks)**
- b) Explain the principle of operation of capacitor motor **(6 marks)**
- c) State **THREE** characteristics of capacitor – start motor. **(4 marks)**
- d) A 4-pole, 250W, 115V, 60Hz capacitor start induction motor takes full-load current of 5.3A while running at 1760 r.p.m. If the full-load efficiency of the motor is 64%, find:
- i. Motor slip
  - ii. Power factor
  - iii. Full-load torque **(6 marks)**