



TECHNICAL UNIVERSITY OF MOMBASA

**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 I

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2017

TIME: 2 HOURS

DATE: Pick Date Select Month Pick 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.

Question ONE

a) Starting from D.C. motor speed equation $N \propto \frac{E_b}{\phi}$ discuss THREE ways of controlling the speed of a

DC motor.

(4 marks)

b) Describe the Ward-Leonard Method of speed control.

(6 marks)

- c) State the advantages and disadvantages of the Ward-Leonard Method of speed control. (5 marks)
- d) 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 $E_o = 500\text{V}$. Calculate the motor torque and speed when $E_s = 400\text{V}$ and $E_o = 380\text{V}$. (5 marks)

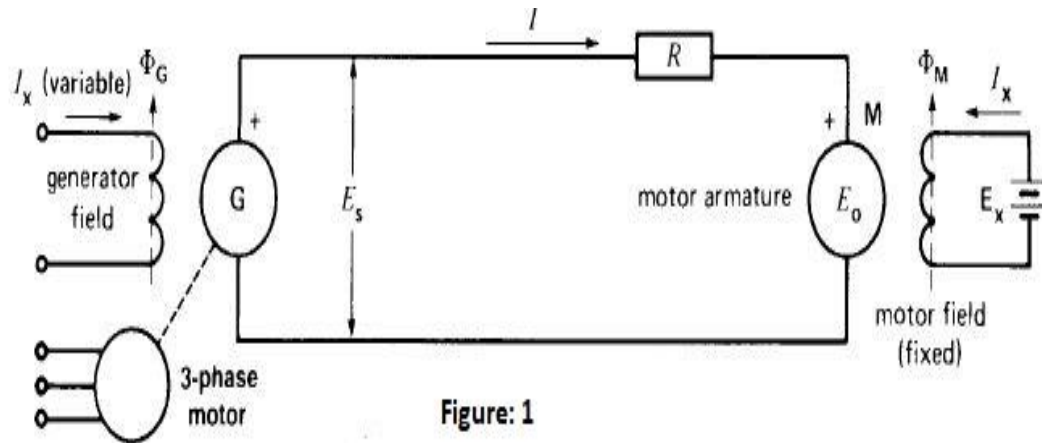


Figure: 1

Figure Q1

Question TWO

- a) Describe the necessity of a starter in a DC Motor (4 marks)
- 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. (3 marks)
- c) Enumerate the steps required in starting of a DC Motor (4 marks)
- d) With an aid of a circuit diagram explain briefly “Resistance step grading” method of shunt DC Motor Starting. (6 marks)

Question THREE

- a) Explain the following:
- Plugging

- ii. Dynamic Braking
 - iii. Regenerative Braking **(9 marks)**
- b) A 20h.p, 220V Shunt motor takes full – load current of 82A, speed 1000rpm, armature resistance 0.1Ω , shunt resistance 110Ω . It is to be braked by plugging. What resistance must be placed in series to limit the current to 120A? Find also the initial value of the braking torque. **(6 marks)**
- c) Mention two disadvantages of mechanical braking. **(2 marks)**
- d) Cite applications of dynamic braking. **(3 marks)**

Question FOUR

- a) Explain the losses in a DC motor. **(4 marks)**
- b) i. Explain the Swinburne’s Method of determining efficiency.
ii. Describe why the Swinburne’s test is preferred in determining efficiency of a DC Machine **(8 marks)**
- c) A 220V DC shunt motor at no-load takes a current of 2.5A. the resistances of the armature and shunt field are 0.8Ω and 200Ω respectively. Estimate efficiency of the motor when input current is 32A. **(8 marks)**

Question FIVE

- a) Mention FOUR main types of single phase motors. **(4 marks)**
- b) Describe the principle of operation of shaded – pole motor **(5 marks)**
- c) Explain the difference between a synchronous motor and a DC motor. **(4 marks)**
- d) List the principle components of an induction motor. **(4 marks)**
- e) i. Explain the importance of circle diagram
ii. List the assumptions made in drawing circle diagram of an induction motor. **(3 marks)**