



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**FIRST SEMESTER EXAMINATION FOR DIPLOMA IN ELECTRICAL AND
ELECTRONICS ENGINEERING**

EED 204: MACHINES 1

DATE: 4/8/2016

TIME: 8:30 – 10:30 AM

INSTRUCTIONS TO CANDIDATES:

Answer Question One and Any Other Two Questions

SECTION A: COMPULSORY QUESTION.

1. (a) State any three advantages of an a.c single-phase capacitor- start and run motor with a starting winding and capacitor permanently connected in the circuit.
(3 marks)
- (b) A 4-pole, 240V, wave-connected d.c shunt motor gives 11.19 kW when running at 1000rpm and drawing armature and field currents of 50A and 1.0A respectively. It has 540 conductors and an armature resistance of 0.1Ω .
Assuming a volt drop of 1V per brush,
Calculate
 - (i) Total torque
 - (ii) Useful flux per pole
 - (iii) Rotational losses
 - (iv) Efficiency(10 marks)

- (c) Explain with the aid of a diagram and characteristics curve the Rheostatic control method as a speed control method for a d.c shunt motor. (9 marks)
- (d) Describe with a diagram the construction and operation of the single-phase series motor. (8 marks)

SECTION B : ATTEMPT ANY OTHER TWO QUESTIONS

2. a) The armature winding of a 200V, 4- pole, series motor is lap-connected. There are 280 slots and each slot has 4 conductors. The current is 45A and the flux per pole is 18 mWb. The field resistance is 0.3Ω ; the armature resistance is 0.5Ω and the iron and friction losses total 800W. The pulley diameter is 0.41 m. Determine the pull in newtons at the rim of the pulley. (6 marks)
- b) Describe with a diagram the construction of a d.c machine. (9 marks)
- c) Explain with the aid of a diagram the flux control method for the control of speed of a d.c shunt motor. (5 marks)
3. a) Describe with a diagram the construction and operation of commutator as a component of a d.c machine (7 marks)
- (b) Explain with the aid of a diagram the arrangement of the following types of armature windings in a two-pole d.c machine
- (i) Lap winding
- (ii) Wave winding (7 marks)
- c) A 220 V d.c series motor is running at a speed of 800 r.p.m and draws a current of 100 A. If the total resistance of the armature and field circuits is 0.1Ω and assuming that the magnetic circuit is unsaturated calculate the speed at which the motor will run when developing half the torque. (6 marks)
4. a) A 250 V d.c shunt motor has an armature resistance of 0.25Ω and on load it takes an armature current of 50 A and runs at 750 rpm. If the flux of the motor is reduced by 10% without changing the load torque, calculate the new speed of the motor. (5 marks)

- b) Describe with a diagram a face - plate starter for a d.c shunt motor with an overload and no – voltage protective device . (8 marks)
- c) Explain with the aid of a diagram and a characteristic curve the construction and operation of a single-phase a.c shaded – pole motor. (7 marks)
5. a) Derive from first principles the expression for the generated emf equation of a d.c machine (6 marks)
- b) Define the term ‘commutation’ with regard to a d.c machine. (2 marks)
- c) The input to a 220 V d.c shunt motor is 11 kW and the particulars of the motor are as follows :
- No-load current = 5 A ; No- load speed = 1150 r.p.m
- Armature resistance = 0.5Ω Shunt field resistance = 110Ω
- Calculate at this load , the (i) Torque developed
- (ii) Efficiency
- (iii) Speed (6 marks)
- d) With the aid of a diagram describe the construction and operation of a single-phase split- phase a.c induction motor. (6 marks)