



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 303: MACHINES AND UTILIZATION 1

DATE: 8/8/2016

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

Answer Question One and Any Other Two Questions

SECTION A : COMPULSORY QUESTION

1. (a) Define the following terms
 - (i) Heating time constant
 - (ii) Cooling time constant (4 marks)
- (b) Describe with aid of a diagram the principle of operation of a transformers: (8 marks)
- (c) (i) State any three advantages of Power factor improvement in a consumer Premises. (3 marks)
 - (ii) An industrial load of 50kW, 240V, 50Hz is operating at 0.6 power factor lagging and 83.3% efficiency. Determine the value of Capacitor required to improve the overall power factor to 0.87 lagging. (6 marks)

- (d) Explain the following factors that may be considered when selecting a motor for a particular Industrial drive.
- (i) Power supply available
 - (ii) Type of starting and control (4 marks)
- (e) Describe the following types of motor enclosures;
- (i) Screen- protected enclosure
 - (ii) Drip-proof enclosure (5 marks)

SECTION B : ATTEMPT ANY TWO QUESTIONS

2. (a) (i) Define the term Power factor. (2 marks)
- (ii) State any three effects of a low Power factor (3 marks)
- (b) A 3600/240V step- down transformer has a no-load current of 1A at a power factor of 0.2 lagging. If the impedance of the windings will be ignored and with the aid of a phasor diagram ,Calculate the Primary current and the Power factor when the Secondary load current is 150A at a power factor of 0.9 lagging. (8 marks)
- (c) Explain the following types of Electric drives for driving mechanical loads;
- (i) Group drive
 - (ii) Individual drive (4 marks)
- (d) State any three disadvantages of a group drive. (3 marks)
3. (a) Define the term ' Voltage Regulation ' of a transformer. (2 marks)
- (b) Describe with aid of a diagram the Open-circuit test of a transformer. (6 marks)

- (c) State the following;
- (i) Any two causes of a low Power factor
 - (ii) Any three advantages of a Power factor improvement using synchronous condensers. (5 marks)
- (d) A 50KW , 415V ,3-phase motor operates on full load at a Power factor 0.75 lagging with an efficiency of 85%. If the Power factor is improved to 0.95 lagging, Calculate ;
- (i) The reduction in KVA demand.
 - (ii) The current taken from the supply. (7 marks)
4. (a) Define the term Efficiency of a transformer . (2 marks)
- (b) With the aid of a Circuit and Phasor diagram, explain the Operation of a practical transformer on load having winding resistances and leakage reactance. (7 marks)
- (c) State any three advantages of an Auto transformer. (3 marks)
- (d) A 100KVA, 2200 / 400V, single- phase transformer has an Iron loss of 850W when open- circuit tested. After a short- test the effective resistance in the secondary is 0.0144Ω .. Calculate the Efficiency of the transformer when it is delivering;
- (i) Full load at unity Power factor
 - (ii) Half full- load at 0.8 P.f lagging. (8 marks)
5. (a) State any three advantages of static capacitors when used for Power factor Improvement. (3 marks)

- (b) A current of 35A is drawn from a 240V , 50Hz a.c supply at a Power factor of 0.75 lagging. If a capacitor is required to improve the Power factor to 0.96 lagging, calculate the;
- (i) Total current drawn from supply
 - (ii) Current drawn by the Capacitor
 - (iii) The size of Capacitor in farads (9 marks)
- (c) Calculate the maximum overload that can be carried by a 20KW output motor if the temperature rise is not to exceed 50°C after 1 hour on overload. The temperature rise on full load after 1 hour is 30°C and after 2 hours is 40°C. Assume losses are proportional to square of load. (6 marks)
- (d) The load cycle of a motor for 15mins in driving equipment is as follows:
- 0 – 5mins : 30 H.P
 - 5 – 9mins : No- load
 - 9 – 12mins 45 H.P
 - 12 – 15mins No- load
- The load cycle is repeated indefinitely. Estimate the suitable size of the continuously rated motor. (2 marks)