



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

THIRD YEAR FIRST SEMESTER EXAMINATION FOR DIPLOMA IN ELECTRICAL
AND ELECTRONICS ENGINEERING

EED 303: MACHINES AND UTILIZATION I

DATE: 6/6/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

SECTION A (Compulsory) (30 MARKS)

1. a) Define the following terms
 - (i) Heating time constant
 - (ii) Cooling time constant (4 marks)
- b) Describe with 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 correct 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 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 Autotransformer. (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 load. (6 marks)
- (d) Describe the electric drive used for coal mining applications. (2 marks)