



MUEO

MOI UNIVERSITY

OFFICE OF THE DEPUTY VICE CHANCELLOR
(ACADEMICS, RESEARCH & EXTENSION)

UNIVERSITY EXAMINATIONS

2016/2017 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER EXAMINATION

FOR THE DEGREE OF

BACHELOR OF ENGINEERING

IN

CHEMICAL & PROCESS ENGINEERING AND MANUFACTURING, INDUSTRIAL & TEXTILE ENGINEERING

COURSE CODE: ECE 202

COURSE TITLE: ELECTRICAL TECHNOLOGY II

DATE: 20TH JUNE, 2017 **TIME:** 2.00 P.M. – 5.00 P.M.

INSTRUCTION TO CANDIDATES

- ANSWER ANY FIVE (5) OF THE FOLLOWING SEVEN (7) QUESTIONS
- ALL QUESTIONS CARRY EQUAL MARKS

THIS PAPER CONSISTS OF (4) PRINTED PAGES

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QUESTION ONE (14MARKS) ✓

- a) State any three major
- advantages of hydro-electric power plants
 - factors to be taken into consideration in selection of site for a hydro-electric power station
- (6marks)
- b) State any one merit and demerit of a thermal (steam) generating plant (2marks)
- c) With the aid of a simplified labeled schematic diagram, explain the principle of operation of a thermal (steam) generating plant (6marks)

QUESTION TWO (14MARKS) ✓

- a)
- Explain the meaning of "armature reaction" as applied to DC machines (2marks)
 - State how the effect in (a) (i) may be minimized (2marks)
- b) State the three major factors that determine the magnitude of e.m.f generated by a DC generator. (3marks)
- c) An 8-pole DC shunt generator consists of 600 lap connected armature conductors. The armature and field resistances are 0.9 ohm and 160 ohms respectively. A load of 30 ohms is connected across the armature terminals and the armature is driven at 1000 r.p.m. The useful flux per pole is 25mWb.
- Draw a clearly labeled circuit diagram of the loaded shunt generator and show the flow of currents. (2marks)
 - Calculate the e.m.f generated (3marks)
 - Calculate the power absorbed by the load (2marks)

QUESTION THREE (14MARKS) ✓

- a) State two major shortcomings of a radial distribution system. (4marks)

b) A 2-wire D.C distributor AB is 2 Km long and supplies loads as follows:

100A at point C which is 500M from A

150A at point D which is 1000M from A

200A at point E which is 1600M from A

50A at point B which is 2000M from A

Each conductor has a resistance of 0.01 Ohm per 1000M.

If 300V is maintained at point A, calculate the voltages at load points C, D, E and B. (10marks)

QUESTION FOUR (14MARKS) ✓

A single phase A.C distributor 500M long has a total impedance of $(0.02+j0.04)$ Ohm (go and return) and is fed from one end at 250V. It is loaded as follows:

- i. 50A at unity power factor 200M from feeding end
- ii. 100A at 0.8 power factor lagging 300M from feeding end
- iii. 50A at 0.6 power factor lagging at the far end

Calculate

- a) Total voltage drop along the whole distributor (10marks)
- b) Voltage at the far end (4marks)

QUESTION FIVE (14MARKS)

a) State any two major

- i. Applications of the three phase synchronous motor (2marks)
- ii. Factors that determine the maximum mechanical power developed by a three phase synchronous motor (2marks)

b) The excitation of a 415V, three-phase, delta-connected synchronous motor is such that the induced e.m.f is 520V. The impedance per phase is $(0.5+j4)$ Ohm. If the friction and iron losses are constant at 1000W, calculate

- i. The line current (2marks)
- ii. The power output (2marks)
- iii. Total copper losses (2marks)
- iv. Power factor (2marks)
- v. Efficiency for maximum power output (2marks)

✓ **QUESTION SIX (14MARKS)** ✓

A 4-pole long shunt lap-wound compound generator supplies a load of 25KW at a terminal voltage of 500V. The armature resistance is 0.03 Ohm, series field resistance is 0.04 Ohm and shunt field resistance is 200 Ohms. If the brush contact drops are negligible, calculate

- a) the armature current (4marks)
- b) the generated e.m.f (5marks)
- c) number of armature conductors if the speed is 1200 rpm and flux per pole is 0.02 weber. (Neglect armature reaction) (5marks)

⊙ **QUESTION SEVEN (14MARKS)**

- a) With reference to three-phase induction motors, define "slip". (2marks)
- b) With the aid of a circuit diagram, explain autotransformer method of starting a three-phase cage induction motor. (4marks)

c) A three-phase, 50Hz, 6-pole induction motor has the following particulars:

Standstill rotor p.d per phase = 80V

Rotor resistance per phase = 0.4 Ohm

Standstill rotor reactance per phase = 12 Ohms

If the motor is running at a speed of 935 revs/min, calculate:

- i. the slip (4marks)
- ii. rotor current per phase (4marks)