UGANDA INSTITUTE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

END OF SEMESTER TWO EXAMINATIONS

ACADEMIC YEAR 2025/2026

DEPARTMENT : **ICT AND ENGINEERING**

SESSION **:** **DAY/EVENING/WEEKEND**

YEAR OF STUDY: **TWO**

PROGRAMMES **:** **DEEE**

COURSE **:** **AC MACHINES AND SYSTEMS II**

COURSE CODE: **ELT 2203**

DATE **:** **FRIDAY, 26TH, JUNE 2026**

TIME **:** **2:00PM-5:00PM [3HOURS]**

EXAM ROOM **:** **TENT B**

INSTRUCTIONS:

i. This paper consists of two (2) sections: Section A and Section B
ii. Section A is compulsory and all numbers **MUST** be attempted
iii. Section A has a total of 40 marks
iv. Attempt ONLY three (3) questions from section B

SECTION A: PART ONE (@2marks)

1. The rotors preferred for alternators coupled to hydraulic turbines are

(a) salient pole type (b) cylindrical rotor type

(c) solid rotor type (d) any of above.

2. The Stator of an alternator consists of

(a) stator frame (b) stator winding

(c) both a and b (c) rotor bars

3. A pony motor is basically a:

(a) DC series motor (b) DC shunt motor

(c) double winding AC/DC motor (d) small induction motor.

4. The armature current in a synchronous motor will be least when p.f. is

(a) zero (b) unity

(c) leading (d) lagging

5. Synchronous reactance of an alternator represents

(a) armature reaction reactance and leakage reactance.

(b) leakage reactance and field winding reactance.

(c) field winding reactance and armature reaction reactance

(d) a reactance connected in series with a synchronous generator.

6. The speed of prime mover for an alternator is maintained constant by

(a) filters (b) coupling

(c) brakes (d) governors

7. When the field of a synchronous motor is under excited, the p.f. will be

(a) zero (b) unity

(c) lagging (d) leading.

8. Two alternators are operating in parallel. What will happen when the excitation of one is increased?

(a) alternator will burn out (b) wattless component will change

(c) power output will reduce (d) the machines will stop

9. Synchronous motors are not self-starting because

(a) starters cannot be used on these machines.

(b) starting winding is not providing on these machines

(c) the direction of rotation is not reversed.

(d) the direction in instantaneous torque reverses after half cycle.

10. Back emf set up in the stator of Synchronous motor depends on

(a) rotor speed (b) load

(c) rotor excitation (d) coupling angle.

SECTION A: PART TWO: SHORT ANSWER QUESTIONS.

1. (a) what do you understand by the term parallel operation of alternators. (2 marks)
   (b) List any four reasons why synchronous generators are operated in parallel? (4 marks)

2. What do you mean by single-layer and double-layer winding? (2 marks)

3. Mention any four characteristic features of a synchronous motor. (4 marks)

4. (a) Define the term "coil pitch" as regards to stator windings. (2 marks)

(b) The armature coils of a 3-phase, 4-pole, 24-slot alternator are short pitched by one slot. Determine (i) distribution factor (ii) pitch factor. (4marks)

5. (a)What is hunting in synchronous machines? (2 marks)

(b) list any four causes of hunting. (4 marks)

(c) Explain two important functions served by damper windings in a synchronous motor. (2 marks)

6. Name the different methods used to determine voltage regulation of an alternator. (4 marks)

SECTION B: ATTEMPT ONLY THREE QUESTIONS.

QUESTION ONE:

(a) What is meant by the term 'short pitched' winding? **(2 marks)**

(b) Explain why in practice we prefer short-pitched windings to any other types of windings. **(3 marks)**

(c) In alternators, for one to find synchronous impedance (Z_s) an **open circuit test** and a **short circuit test** must be performed. As a UICT graduate, discus how these tests are conducted to come up with synchronous impedance value. (use clear illustrations and drawings) **(7 marks)**

(d) A single-phase, 500 V, 50 Hz alternator produces a short-circuit current of 170 A and an open circuit emf of 425 V when a field current of 15A passes through its field winding. If its armature has an effective resistance of 0.2 ohm, determine its full-load regulation at unity pf and at 0.8 pf lagging. **(8 marks)**

QUESTION TWO:

(a) What is meant by the term synchronising? **(2 marks)**

(b) Mention any three methods used in synchronising of three phase alternators. **(3 marks)**

(c) Discus any one of the above methods in detail with the help of drawings and illustrations. **(6 marks)**

(d) The two alternators I and II having a full-load capacity of 500 kW each are operating in parallel. Their speed regulation is 100% to 104% and 100% to 105% from full-load to no-load, respectively. How will they share a load of 600 kW. Also find the load at which one machine ceases to supply any load? **(9 marks)**

QUESTION THREE:

a) What is two-field revolving theory as applied to single phase induction motors? **(2 marks)**

b) State any three important applications of shaded pole motors. **(3marks)**

c) Explain the construction and working of a single-phase capacitor start capacitor run induction motor. **(5marks)**

d) The parameters of the main and starting winding of a 240 V, 50 Hz split-phase induction motor are given as:

Main winding: $R_m = 6\Omega$; $X_m = 8\ \Omega$

Starting winding: $R_S = 8\Omega$; $X_S = 6\ \Omega$

Determine:

(i) Current in the main winding

(ii) Current in the starting winding

(iii) Phase angle between I_m and I_S

(iv) Line current and pf of the motor

(v) Power drawn by the motor. **(10 marks)**

QUESTION FOUR:

(a) What do you understand by the term "synchronous condenser"? **(2 marks)**

(b) State any four applications of synchronous motor. **(4 marks)**

(c) Describe with the help of neat sketches, the principle of operation of a 3-phase synchronous motor. **(6 marks)**

(d) By use of a phasor diagram of a synchronous motor, explain the effect of ;

(i) Change in excitation if load is constant. **(4 marks)**

(ii) Change in load if excitation is constant. **(4 marks)**

QUESTION FIVE:

(a) Define the term over-excitation with reference to synchronous machines. **(2 marks)**

(b) List any four types of torques exhibited by a synchronous motor. **(4marks)**

(c) Using phasor diagrams, show and explain the action of synchronous motor from no load to full load. **(6 marks)**

(d) With the help of neat sketches discuss any two methods of starting synchronous motors.

(8 marks)

END.