



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

TRADE DIPLOMA IN ELECTRICAL ENGINEERING - Stage 3

EEE533- ELECTRICAL MACHINES

FINAL EXAMINATION –SEMESTER-1, 2015

Total Marks---100%

Day/Date: As per timetable Time: As per timetable Room: As per timetable

INSTRUCTIONS TO STUDENTS

1. *You are allowed 10 minutes Extra reading time during which you are NOT to write.*
2. *Begin each answer on a fresh page and use both sides of the sheet.*
3. *Write your candidate-number at the top of each attached sheet*
4. *Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string*
5. *For all sheets of paper on which rough/draft work has been done, cross it though and you MUST ATTACH to your answer scripts.*
6. *Write clearly the number(s) of the question(s) attempted on the top of each sheet.*
7. **ANSWER ALL QUESTIONS.**
8. *Show all workings where necessary.*
9. *Do not use programmable calculators, especially the ones that does the conversions of number systems.*

SECTION A-----SHORT ANSWERS -----50 MARKS

1. State Lenz's law. (2 marks)
2. Outline the difference between a single phase motor and a 3 phase motor. (4 marks)
3. Relate as to why single phase motors have problem with starting compared to three phase motors. (2 marks)
4. Illustrate purpose of a run capacitor in a capacitor –start capacitor run motor? (2 marks)
5. State two applications of shaded pole motors. (2 marks)
6. Apply the uses of synchronous motor. Name and explain (3 marks)
7. Demonstrate through a circuit diagram, the load/speed and load/torque graphs of a shunt-field motor. (4 marks)
8. Relate by naming six parts of a motor. (3 marks)
9. Illustrate how is the direction of rotation reversed in a compound motor? You may use diagram to elaborate your answer (2 marks)
10. Outline the specific uses \ application of the following types of generators:
 - a) separately excited permanent magnet (1 mark)
 - b) wound field (1 mark)
 - c) shunt excited (1 mark)
11. State two principal losses of machines (2 marks)
12. Illustrate three requirements that have to be met before synchronizing a Generator. (3 marks)
13. Outline the operation of an on-load transformer with the aid of diagrams. (3 marks)
14. State two advantages of autotransformers (2 marks)
15. State and briefly discuss the two different methods of cooling transformers (2 marks)
16. Specify the purpose of having tap changers on transformers? (2 marks)

17. State the three requirements for connecting a transformer in parallel and explain the effects of each. (3 marks)
18. Draw the following transformer connections:
a) Star – Delta b) Delta – Delta (2 marks)
19. Draw the control part of a DOL starter and state its operation. (4 marks)

SECTION B-----CALCULATIONS-----50 MARKS

1. A 20 kW shunt-connected generator operates with a terminal voltage of 240 V. The armature has an effective resistance (R_a) of 0.18Ω and the shunt field (R_{sh}) has a resistance of 120Ω .
Calculate:
(a) The full load current. (2 marks)
(b) The field current. (2 marks)
(c) The total armature current (2 marks)
(d) The induced armature volt (3 marks)
2. A transformer operating at no load draws an exciting current I_o of 5A when primary is connected to a 120v 60Hz source from a wattmeter test it is known that iron losses are equal to 180W.

Calculate:
a) The reactive power absorbed by the core (2marks)
b) Value of R_m and X_m (2marks)
c) Value of I_f , I_m , I_o (2marks)
3. A single phase transformer has a rating of 100kVA, 7200V/600V, 60 Hz.
If it is reconnected as an autotransformer having a ratio of 7800V/7200V, calculate the load it can carry. (4marks)
4. An ideal transformer has a turn's ratio of 8:1 and the primary current is 3A when it is supplied at 240V. Calculate the secondary voltage and current. (4 marks)

5. A voltmeter ,ammeter and wattmeter are connected to a single-phase circuit, by means of the appropriate instrument transformers, and the following results are obtained:

CT ratio	100:5
PT ratio	11 000:110
Voltmeter reading	10500 V
Ammeter reading	90 A
Wattmeter reading	870 W

Calculate the actual voltage, current, volt-amperes and power in the secondary circuit.
(5 marks)

6. A 4-pole generator has a lap-wound armature with 50 slots with 16 conductors per slot. The useful flux per pole is 30mWb. Determine the speed at which the machine must be driven to generate an e.m.f. of 240V
(5 marks)

7. The armature of 4 pole lap wound armature contains a total of 300 effective conductors, given the magnetic flux as 0.02Wb per pole and the speed of rotation as 1000rpm.

- a) Calculate the generated voltage. (2.5marks)
b) Calculate the voltage generated if the armature was WAVE connected (2.5marks)

8. A d.c. motor operates from a 350V supply. If the armature resistance is 0.4 determine the back e.m.f. when the armature current is 60A
(3 marks)

9. A three-phase two-pole induction motor is connected to a 50 Hz supply. Determine the synchronous speed of the motor in rev/min
(3 marks)

10. A 3-phase, 60 Hz induction motor has 2 poles. If the slip is 2 per cent at a certain load, determine

- (a) the synchronous speed, (2 marks)
(b) the speed of the rotor, and (2 marks)
(c) the frequency of the induced e.m.f. in the rotor. (2 marks)

.....THE END.....